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CARCINOMA OF THE LUNG AND BRONCHUS

TREATMENT WITH RADON IMPLANTATIONS AND DIATHERMY

JOHN D. KERNAN, M.D.

NEW YORK

Primary carcinoma of the lung has been designated as a new disease. It is certain that no longer than twenty years ago it was rarely recognized during life and only infrequently at autopsy. The statistics gathered and summarized by Fried in his recent book [1] show that a steady increase can be noted in the ratio which this form bears to all other carcinomas.

There are probably two points which, considered in this connection, would seem to explain the increase in frequency. In the first place, many more people are living to reach the so-called "cancer age," that is, middle life. Among these people, this form of carcinoma manifests itself and is recognized more often. Here, then, is a real increase in frequency which is probably running parallel to the increase in carcinoma in general. In the second place, means of diagnosis have been greatly improved in the last fifteen or twenty years. These years have seen the development of x-ray technic, bronchoscopy and more accurate laboratory methods. It is therefore probable that part of the seeming increase is not actual but due to more frequent recognition of the disease. I have in my own files records of approximately sixty proved cases of carcinoma of the lung or bronchus in which I performed bronchoscopy. All of the patients have been seen since 1925, although I have been doing bronchoscopies for the past twenty years. However, I do not think that this number gives a true picture of the actual number of cases in the hospitals where I was working over this same period. The following record will serve to illustrate this point.

At one hospital alone, there were sixty-six cases which were diagnosed as carcinoma of the lung during the past six years. Of these, only twenty-two came to bronchoscopy so that carcinoma might be diagnosed by means of biopsy or visible pulmonary signs. A few of the other cases were diagnosed from biopsies of cervical nodes or at autopsy, but the diagnoses of the rest were based on roentgen or

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1. Fried, B. M.: Primary Carcinoma of the Lung, Baltimore, Williams & Wilkins Company, 1932.

physical signs alone. The true number of actual cases in the series, therefore, may be open to doubt. It is interesting to note that in the past month I have seen six proved cases of the disease, three of them in the same hospital on the same day.

I mentioned the fact that more people are living to reach the "cancer age." There is doubt in my mind as to whether or not there is definitely a "cancer age." It is true that most of the people in whom active carcinoma develops and who die of it do so in middle life, but can one be sure that the disease itself did not begin many years before the manifestation of recognizable symptoms? I wish to quote, in this connection, one case which brings out the fact that true carcinoma may be found early in life and last many years.

REPORT OF CASES

CASE 1.—A girl, aged 17, was referred to me by Dr. J. A. Miller in April, 1927. She had had a tonsillectomy at the age of 7, at which time she bled profusely. After this, she was well for four years, when at the age of 11, she had a pulmonary hemorrhage. During the next six years, she had occasional pulmonary bleeding, but, aside from this, was in good health. During the course of years, she had undergone various examinations. In January, 1924, three years before I saw her, an x-ray picture of her chest showed a tumor in the lower lobe of the right lung. The roentgenologist thought that the shadow in the lung could be an abscess or some form of benign or metastatic tumor. After taking the history into consideration, it was thought that the lesion was either an old chronic abscess, not at present draining, or a dermoid cyst. The absence of surrounding inflammatory changes made one think more of a tumor. The patient was then 14 years old. A severe hemoptysis in 1927, the attack lasting three or four hours, brought the patient to Dr. Miller and to me. On April 26, 1927, bronchoscopic examination disclosed a large vascular tumor lying in the lower main bronchus of the right lung. The tumor sprang from the mucous membrane, and was rough, friable and extremely vascular.

A specimen was taken for biopsy, and the following report was made by the pathologist: "Sections of the tumor fragments show a malignant growth, the bulk of which is composed of small alveoli filled with rather small cells with poorly defined outlines and round or oval nuclei. The alveolar walls are thin and cellular. In one part of the tumor, the cells take a deeper stain and appear somewhat larger than the rest of the cells. These cells are disposed in compact masses or in imperfect columns supported by strands of vascular stroma. Tumor emboli are present in the smaller blood vessels. The general structure suggests a pulmonary origin. Diagnosis—malignant tumor, probably carcinoma." It was graded 4 on Broder's scale of malignancy (fig. 1).

The further history of this patient is interesting. She received a course of high voltage roentgen treatments in 1927, after which she had a pleural effusion. From then until the time of writing this article she has been perfectly well, with no more bleeding and no pulmonary symptoms. Roentgenograms of her lungs, however, still show the same shadow (fig. 2).

Here, then, is a patient who, at the age of 17, was found to have a proved carcinoma of the lung. The tumor was probably there at the age of 11, and now after eight years, gives no symptoms and apparently has no deleterious effect on her health.

Fig. 1 (case 1).—Shadow in lung eleven years after onset of symptoms.

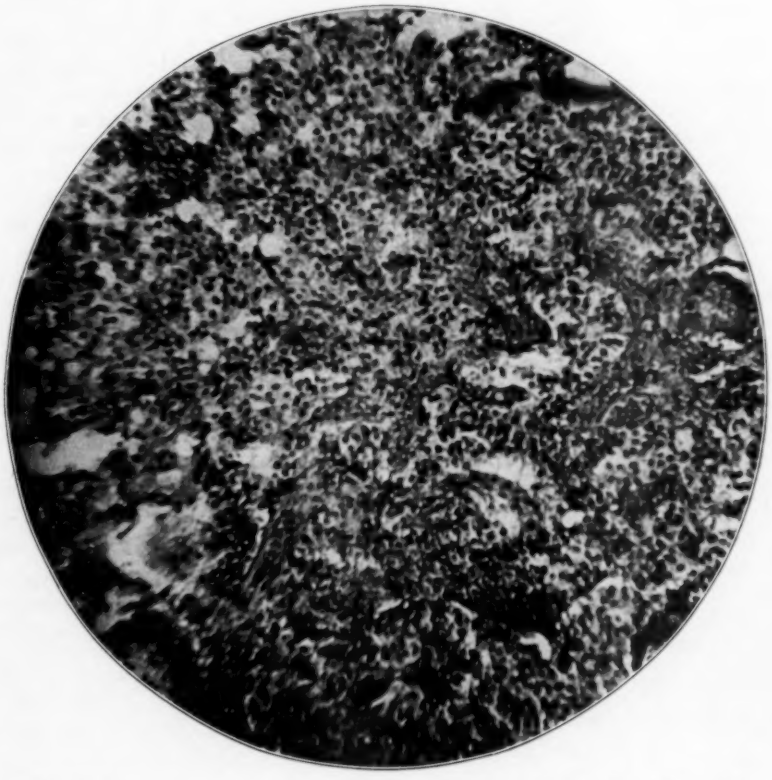

Fig. 2 (case 1).—Section of tumor removed from lung at bronchoscopy.

Of the sixty cases in which I performed bronchoscopies, the tumors in only five were early enough and accessible enough to offer any chance of cure. The reason for this is that the disease is rarely suspected until it is far advanced. The symptoms may be obscure and may not even point to trouble in the lung. When pulmonary symptoms finally develop, it is too late for treatment. Taking it for granted that such cases seem to be becoming more frequent, whether the increase is seeming or real, diagnosis becomes all the more important, for only the early cases offer any hope of cure or even improvement by treatment. As one of the most important methods of early diagnosis and treatment, I wish to advocate the use of the bronchoscope and to support its recommendation by the report of cases. The first symptoms may be cerebral, from a metastasis to the brain, or gastric. They may apparently be connected with some distant organ, with or without metastases, or they may be merely a slowly increasing debility with no localizing signs. When pulmonary signs do occur, they may be so slight as to attract little attention. Then, when examination of the lungs is finally made, it may be too late. The point I wish to urge is that in the investigation of all obscure symptom complexes, the bronchoscopist should have a part.

In this connection I should like to quote one or two cases.

CASE 2.—A college professor, aged 55, had been treated for sinusitis and frequent colds for several years. Later on in his illness asthma developed, with cough and a slightly bloody sputum. No roentgenograms were taken at this time, except of the sinuses, as it was felt that the thoracic signs could be explained on the basis of his sinus condition. Finally, he became increasingly weak and came under the care of Dr. J. A. Miller. Examination of the chest with the x-rays revealed a tumor in the upper lobe of the right lung which was thought to be benign because of the long duration of the symptoms and his comparatively good health. At bronchoscopy, a well differentiated tumor was found in the right upper lobe bronchus. Sections of the tumor proved it to be a carcinoma, which was graded 1 on Broder's scale (fig. 3). In spite of the implantation of radon seeds and the use of diathermy, the patient died two months later, though he had had some relief from cough and discomfort before he died.

CASE 3.—A woman, aged 41, came to the Lenox Hill Hospital in August, 1930, complaining of weakness and loss of appetite which she had noticed for the past ten months. Routine fluoroscopic examination revealed the presence of a small mass in her right lung (fig. 4). Bronchoscopy was performed, and a pedunculated tumor was found just below the mouth of the right lower lobe bronchus, obstructing the entire lumen. It was removed, and radon seeds were immediately inserted. Sections of the tumor were graded 3 as to malignancy (fig. 5). The patient has been observed at frequent intervals since then, and bronchoscopic examination shows a bronchiectasis but no sign of tumor. Her general health is good (fig. 6).

Some carcinomas of the lung begin early in life, as I have shown in my first case. They do not metastasize early and are found in the

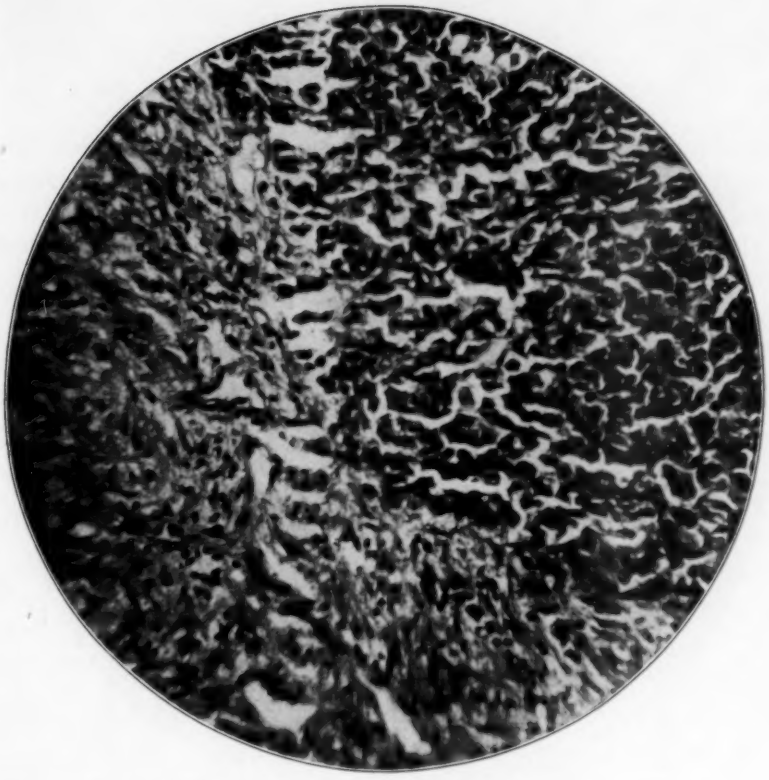

Fig. 3 (case 2).—High power view of section from tumor removed at bronchoscopy.

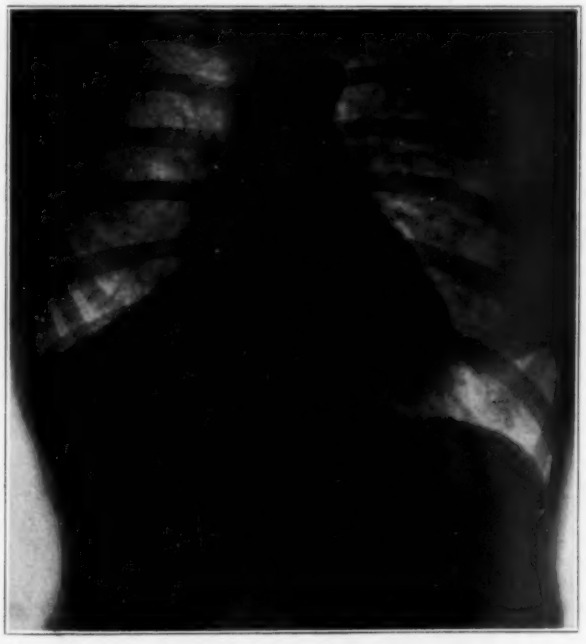

Fig. 4 (case 3).—Roentgenogram of lung taken before treatment.

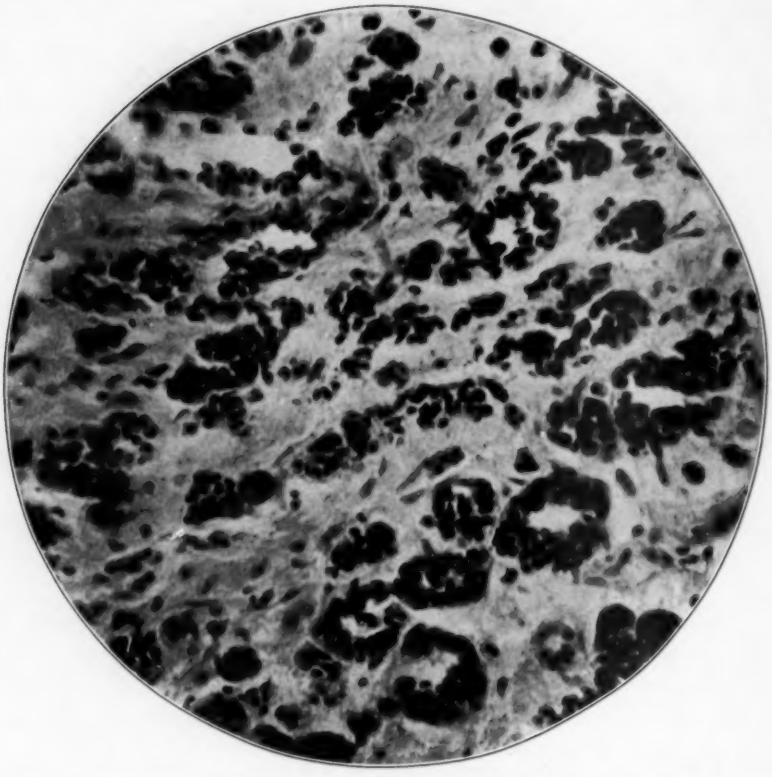

Fig. 5 (case 3).—High power view of section from tumor removed at bronchoscopy.

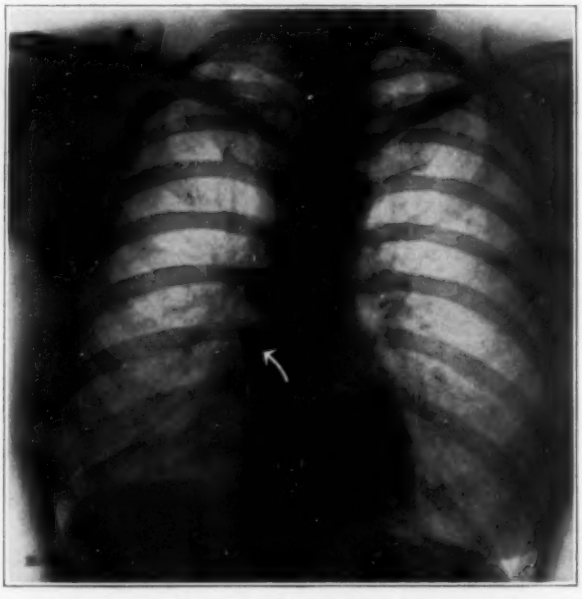

Fig. 6 (case 3).—Roentgenogram of lung taken two years after treatment with radon seeds and diathermy. Radon seeds still visible (arrow).

large bronchi. If the diagnosis of these tumors can be made soon enough, they are amenable to treatment by radon implantations and diathermy. Case 3 is also an illustration of this point, and I wish to quote a few others as well.

CASE 4.—A woman, aged 35, was first seen by me in December, 1926. For the preceding four years (from 1922 on), she had had several attacks of atelectasis of the left lung. In 1925, one year before I saw her, bronchoscopy was performed with negative findings, except for the presence of a slight constriction of the left bronchus. After each attack, the average duration of the attacks being

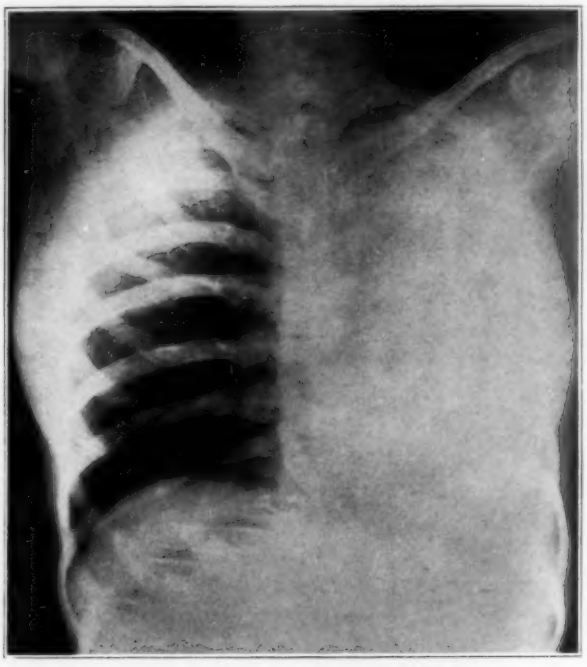

Fig. 7 (case 4).—Roentgenogram taken at height of attack, showing massive collapse of left lung.

about two weeks, the lung would expand and roentgenologic and fluoroscopic examination would give negative results. About one week before she came to me, an attack began, with fever, pain in the left side of the chest, dyspnea and cyanosis. Roentgenograms showed the left lung to be solid in appearance, with movement of the heart and mediastinal contents to the left (fig. 7). A bronchoscopic examination was made which disclosed a tumor in the left main bronchus, just below the mouth of the upper lobe bronchus. Sections of this tumor were diagnosed carcinoma of grade 4 malignancy (fig. 8). One week later, as much of the tumor as possible was removed with punch forceps. Thereafter, the lung rapidly cleared up. Several more bronchoscopies were done, and in February, 1927, two months after the tumor had been discovered, three radon seeds were inserted in the base and the rest of the growth was thoroughly destroyed with diathermy.

As long afterward as January, 1928, the tumor was still present but it was small, white and solid, without vascularity. In November, 1928, no sign of the growth was found on bronchoscopy.

At the time of writing this article, three and a half years after the last treatment and the disappearance of the tumor, the patient is still well; a recent bronchoscopy showed no local recurrence of the growth (fig. 9). It is interesting to note that the pathologist reported this tumor as likely to be radiosensitive because of its excellent capillary blood supply. This case has already been reported in the literature.[2]

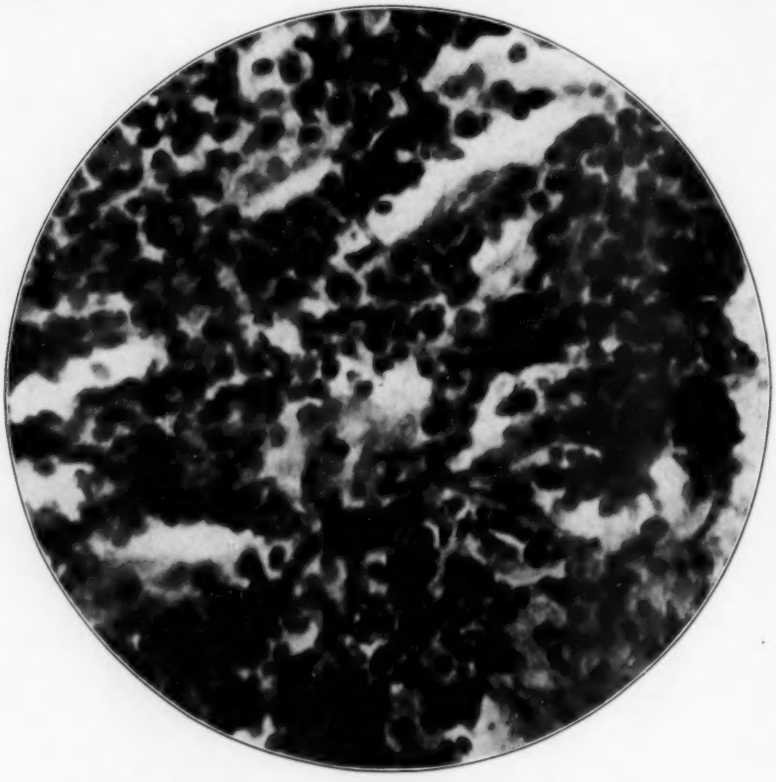

Fig. 8 (case 4).—Section of tumor removed at bronchoscopy.

In connection with the slide from case 4 which shows the injection of iodized poppy seed oil 40 per cent, I wish to call attention to the bronchiectasis. It is difficult to say whether the growth causes obstruction and secondary bronchiectasis, or whether the bronchiectasis furnishes a chronic irritation which acts as a stimulation to the carcinoma. It should be noted that in every case I shall report there was a bronchiectasis or an abscess below the point of the new growth.

2. Kernan, J. D., and Cracovaner, A. J.: Carcinoma of the Lung, Arch. Surg. **18**:315 (Jan. pt. 2) 1929.

CASE 5.—A man, aged 44, had had pulmonary symptoms for sixteen years, with slight spitting of blood occasionally. Four years before he was seen by me, he had an attack of asthma, and from then on until he came under my care, he had occasional attacks of asthma, accompanied by slight hemoptysis. Two weeks before admission, a cough developed, with marked dyspnea on exertion and a real wheeze. He also began to have pain in the right side of the chest, and roentgenograms showed a slight infiltration of the right lung. Bronchoscopy was performed, and a mass of neoplasm was found in the right main bronchus, completely blocking it. Examination of the section taken proved it to be a growth of grade 4 malignancy. Bronchoscopy was again performed three days later, and ten radon seeds were inserted into the growth, some of them being pushed through the

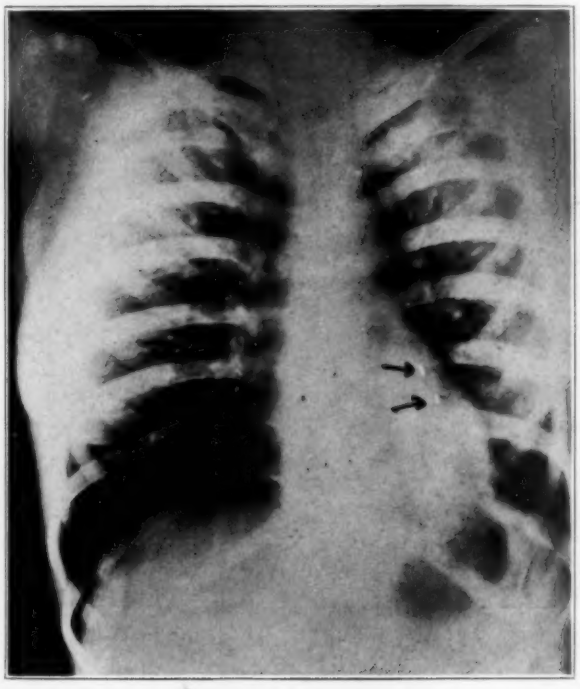

Fig. 9 (case 4).—Film taken two years after treatment. Patient free from symptoms.

bronchial wall into the surrounding tissue under the guidance of the fluoroscope. This was the only case in which I ventured to penetrate deeply with the seeds into the lung tissue. Strings had been attached to the seeds, and one month later nine of them were removed. This patient showed no bad effects from the insertion of the radon and even felt fairly well for a few months, but he died shortly afterward.

CASE 6.—A woman, aged 47, was admitted to the Presbyterian Hospital, with a history of pulmonary troubles which dated back thirty years. She had been treated for tuberculosis, although no bacilli had ever been found in her sputum. Nineteen years before her admission, a bronchiectasis had been found in the right lung, and she had also been subject to pulmonary hemorrhages for twenty-five

years. She came to the hospital because of pain in the right side of the chest which she had had for the past three days. She was in poor general condition. A roentgenogram showed a mass in the right main bronchus. Four radon seeds were implanted in the growth, following which she had a severe reaction with high fever. Three weeks later, roentgenograms of her lung showed no change, but her fever had subsided. She was finally able to be discharged to the care of her family, though little hope was entertained of her recovery or even improvement. However, she came back a year later able to be up and around, and roentgenograms showed slight improvement in the shadow of the lung. Last week, she walked into the clinic; she was able to be quite active, and had had no hemoptysis for over a year. At that time it was three years since her first bronchoscopy. Sections taken at the first bronchoscopy were diagnosed epithelioma of the bronchus. It is interesting to note that she had gone to another hospital a year

Fig. 10 (case 7).—Before bronchoscopy. Collapse of left lung.

previously, where another bronchoscopy had been done. The report from there was that some tumor tissue was still present, but a biopsy showed it to be nonmalignant.

CASE 7.—A woman, aged 32, came to the Presbyterian Hospital in October, 1929, complaining of a cough which she had had for the past eighteen months. The cough had begun suddenly, with slight hemoptysis, and was accompanied by sputum which varied in amount and was occasionally foul. Four days before admission, a severe pain developed in the left side of the chest, with fever. Roentgenograms showed haziness of the left lung, with fixation of the left side of the diaphragm (fig. 10). Bronchoscopic examination disclosed a neoplasm in the left main bronchus, just below the mouth of the upper lobe bronchus. It sprang from the mucous membrane and appeared almost pedunculated. Sections were taken and diathermy applied. Examination of the sections showed definite carcinoma of grade 4 (fig. 11). Two weeks later, two radon seeds were inserted into the base of the growth, which was much shriveled from the diathermy and no longer vascular. In January, 1930, the chest was clear, and bronchoscopy showed a red-

dened area where the tumor had been. Diathermy was again applied at this time. In April, 1930, six months after the first treatment, all signs of the tumor had disappeared, and the area at the base had healed. In February, 1932, two years after the disappearance of the tumor, bronchoscopy showed no sign of recurrence, and roentgenograms showed the chest to be clear (fig. 12).

CASE 8.—A man, aged 50, was sent to me for bronchoscopic examination because his roentgenograms were thought to be characteristic of bronchial carcinoma. He had been examined for a slight cough three years previously, and had also been treated for sinus trouble, but no pathologic process was found in his

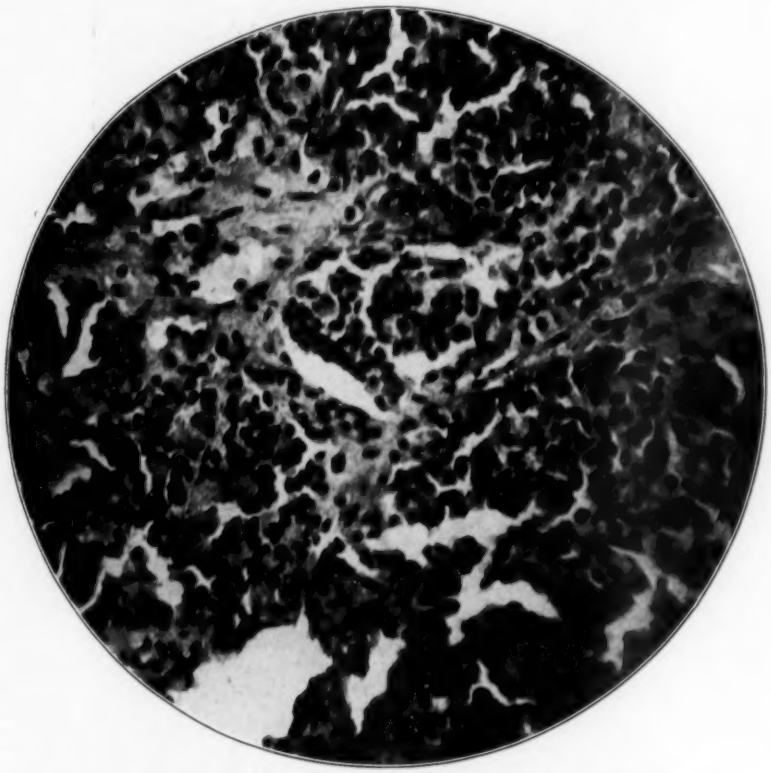

Fig. 11 (case 7).—Section from tumor removed at bronchoscopy.

chest. Two months before I saw him, a slight cough again developed, with little expectoration and pain in the left side of the chest. There was no blood in the sputum. Roentgenograms showed a shadow in the upper part of the left lower lobe (fig. 13). When bronchoscopy was performed, however, a pedunculated tumor was found in the first dorsal branch of the left lower lobe bronchus, far from the shadow in the lung according to the x-rays. This tumor was removed seemingly whole, and was pulled off like a papilloma. Sections showed this to be a squamous cell epithelioma of the bronchus of grade 3 malignancy (fig. 14). The result of this interference was immediate, with complete relief of all symptoms. Both the cough and the expectoration stopped, and, so far as the patient himself felt, he was perfectly well and entirely satisfied with the results of the

Fig. 12 (case 7).—Three years after treatment. Lung completely clear except for some bronchiectasis, which is hidden by the heart shadow.

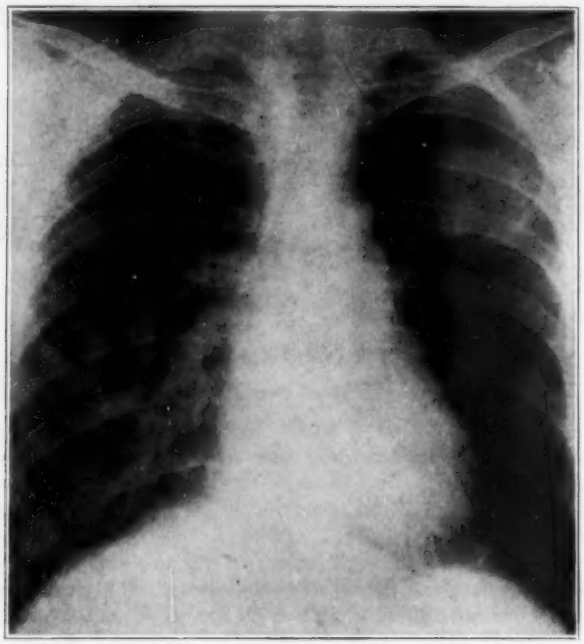

Fig. 13 (case 8).—Shadow of tumor (?) in left lung. At bronchoscopy, tumor was found at mouth of left lower lobe bronchus.

treatment. Roentgenograms taken two months after removal of the tumor still showed the same shadow in the left lower lobe, which I took to be a metastasis. It is still too soon to draw any conclusions as to prognosis. A lobectomy was proposed in this case, as the shadow seemed far from the root of the lung, in a position making possible complete removal of the tumor. The peculiar advantage of bronchoscopy was shown here in the fact that the original tumor was in the bronchus, close to the hilus, where a lobectomy could not possibly have reached it.

CASE 9.—A man, aged 40, was admitted to New York Hospital complaining of dyspnea and what was thought to be anginoid pain in the left side of his chest

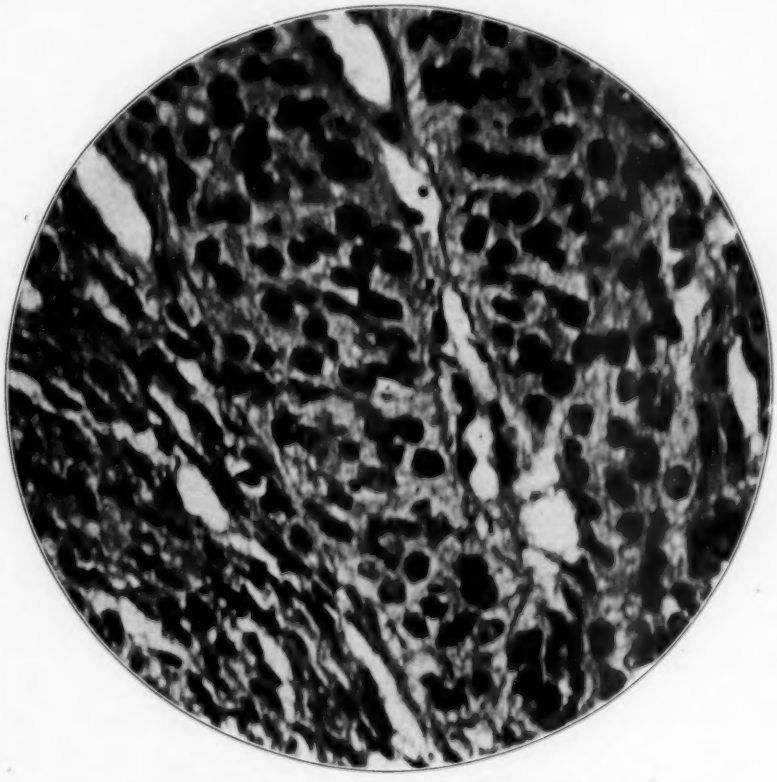

Fig. 14 (case 8).—Section of tumor removed at bronchoscopy.

and arm of seven weeks' duration. A roentgenogram showed atelectasis of the lower lobe of the left lung. Bronchoscopy revealed a mass filling the left main bronchus, sections of which were diagnosed as carcinoma of the bronchus of grade 3 malignancy (fig. 15). Four radon seeds were inserted into the base of the growth and diathermy applied. This treatment relieved the dyspnea temporarily, but the patient later got worse again. Two radon seeds were inserted a month later, which again relieved his discomfort, though the mass at the time the second bronchoscopy was made seemed not to have diminished in size. Some deep roentgen treatments were given, with no relief of symptoms, and again three

radon seeds were inserted. After this, he had no more dysynea, but he became rapidly weaker, and died soon after the last treatment, four months from the onset of his first symptoms.

Case 10.—A woman, aged 28, was admitted to Lenox Hill Hospital, complaining of cough and pain in the right side of the chest of two years' duration. Bronchoscopy showed the right main bronchus to be closed by a tumor. Sections of the tumor were diagnosed as adenoma, possibly adenocarcinoma. Two radon seeds were inserted into the growth and diathermy applied. Bronchoscopy, two

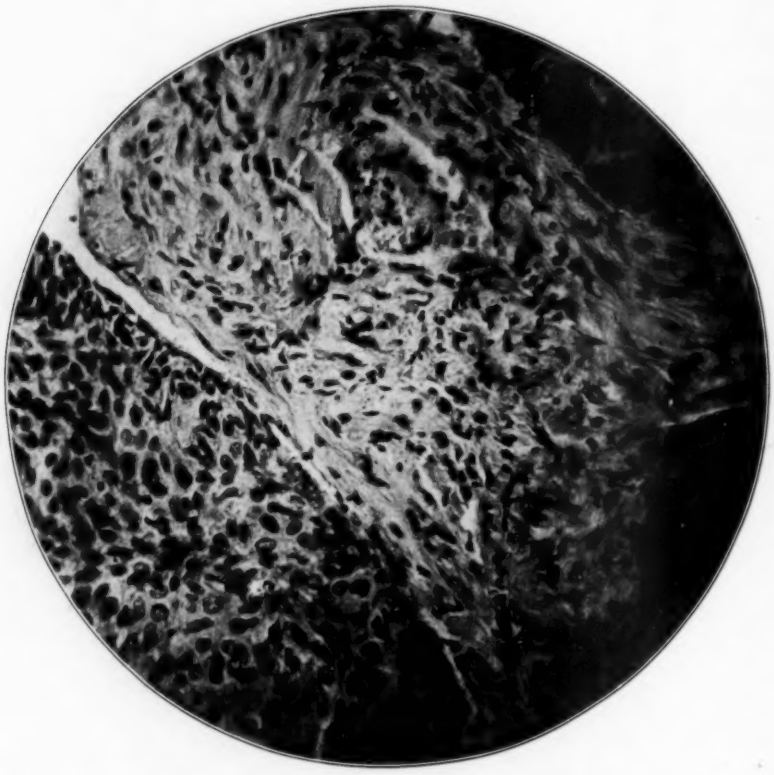

Fig. 15 (case 9).—Section of rapidly developing and fatal tumor found at bronchoscopy in a man 40 years of age. Intensive treatment unavailing.

months later, showed that the tumor had entirely disappeared and the symptoms had cleared up. A recent bronchoscopy, two years after the insertion of the radon, revealed no recurrence of the tumor, and the patient was perfectly well.

COMMENT

If the cases are considered altogether (table), it will be seen that they have several points in common. Most of them were of fairly long duration. All of the tumors sprang from the mucous membrane

Summary of Cases Reported.

Case	Age	Sex	Duration of Symptoms	Symptoms	Roentgen Findings	Bronchoscopy	Pathology	Malignancy	Treatment	Course	Present Condition
2	55	♂	Several years	Sinusitis; asthma; weakness	Mass in right upper lobe	Tumor in and around right upper lobe of bronchus	Carcinoma of bronchus	2	Radon, 5 seeds; diathermy	Felt better; no improvement; x-ray	Died after 2 months
3	41	♀	10 mos.	Anorexia; loss of weight	Shadow of right lower lobe on fluoroscopy	Pedunculated tumor mouth of right lower lobe of bronchus	Adenocarcinoma of bronchus	3	Radon, 4 seeds; diathermy	Steady improvement	Well except for bronchiectasis, 3 yrs.
4	35	♀	4 yrs. (1922)	Attacks of atelectasis of left lung; pain in chest	Lung solid during attack; almost clear after attack	Pedunculated tumor below mouth of left lower lobe of bronchus; lumen filled	Carcinoma of bronchus	4	Tumor removed; radon, 5 seeds; diathermy	Tumor gone in 2 yrs.; lungs clear	Lungs clear; well; no recurrence or metastasis; tumor has been gone 3 yrs.
5	44	♂	16 yrs.	Cough; hemoptysis; asthma; pain in right side of chest 2 wks.	Slight infiltration of right lung	Mass filling right main bronchus	Carcinoma of lung	4	Radon, 10 seeds (in tumor and lung tissue); 9 seeds removed, 1 mo.	Improved for 2 mos.	Died after 3 mos.
6	47	♀	.....	Cough,30 yrs.; pulmonary hemorrhage, 25 yrs.; bronchiectasis, 19 yrs.; pain, 3 days	Mass in right lung	Pedunculated tumor mouth of right lower lobe of bronchus; lumen filled	Epithelioma of bronchus	..	Radon, 4 seeds; roentgen treatment	Severe reaction to radon; improved slowly; shadowless	Still living, 3 yrs.; no symptom for 1 yr.; tumor present but benign, 1 yr. ago
7	32	♀	18 mos.	Cough; hemoptysis; pain, 4 days	Haziness of left lung	Pedunculated tumor of left main bronchus	Carcinoma of bronchus	4	Radon, 2 seeds; diathermy	Lung clear in 6 mos.	Well, no recurrence of tumor, 3 yrs.
9	40	♂	7 wks.	Dyspnea; pain in left side of chest	Atelectasis of left lower lobe	Mass filled left left main bronchus	Carcinoma of bronchus	3	Radon, 9 seeds; diathermy	Cough and dyspnea stopped	Died after 3 mos.
10	28	♂	2 yrs.	Cough; pain, right side of chest	.....	Right main bronchus closed by tumor	Adenocarcinoma of bronchus	..	Radon, 2 seeds; diathermy	Tumor gone in 2 mos.	Well, no recurrence of tumor, 2 yrs.

of the large bronchi. In spite of the fact that all of the successful cases, that is, successful from the standpoint of the present condition, were graded malignant on Broder's scale, none had metastasized. It was possible to destroy the tumors with diathermy and radon implantations, and there have been no local recurrences as yet, although one case has been followed for five years. All of the successful cases were in women. From this category, I must exclude case 8, as this patient was seen for the first time only three months ago. It should be noted that all of the patients had suppuration in the lung beyond the site of the tumor. The symptoms varied, two patients having pulmonary atelectasis and one gastric symptoms only; some had pulmonary signs from the beginning, with cough, pain in the chest and bleeding, while one patient suffered from pulmonary hemorrhages only, and two were thought to have tuberculosis until the tumor was discovered. It should also be noted that when pulmonary signs do occur in some of the early tumors, they are due to blocking of the bronchus, and roentgen examination suggests a much more extensive pulmonary disease than is really the case.

In this connection should be mentioned the case reported in which there was complete filling of one lung, whereas the tumor was comparatively small and was situated in the left main bronchus.

Youth seems to have played some part in the series I have presented, although some writers have felt that carcinoma in younger subjects is more apt to be rapidly fatal than in older ones. One girl, who is still well after eight years, in spite of a tumor graded 4, was only 17 at the time her case was diagnosed. Two others who are still well after five and two and a half years, respectively, were under 35 years of age, while the remaining two, who have lived two and three years after the tumors were treated, are both under 50.

In the early diagnosis of this condition, only the bronchoscope can help, unless signs of blocking of a bronchus occur. Roentgen and physical signs may show nothing.

At this point, one may question whether treatment had anything to do with the fact that the patients are well now. It will be recalled that the patient who has lived the longest had only a short course of roentgen treatment, but she still has the same shadow in her lung. This case suggests that the disease carcinoma may not lie in the tumor which, histologically, is carcinoma. There must be some condition of the body metabolism that is the real disease of which the tumor is only the local manifestation. Thus, one may say that, although all signs have disappeared in three other cases, it does not necessarily mean that there has been a cure of the disease. I have no answer to that statement. I can say, however, that of all the patients with

proved cases of carcinoma of the lung who have come to me for bronchoscopy, the five whose cases are here reported as successful are the only ones who have lived more than six months after a diagnosis was made. The question as to whether the disease itself is cured in these instances will not be answered until the problem of carcinoma is completely solved.

120 East Seventy-Fifth Street.

ABSTRACT OF DISCUSSION

Dr. Henry K. Pancoast, Philadelphia: The implantation of radon in the lower respiratory tract for bronchial carcinoma is an advance in the treatment of what has been a hopeless condition. Even this, however, is probably not the last word in the treatment of bronchial carcinoma. What is seen in the bronchoscope is usually not the entire growth. Moreover, the roentgenogram presents no characteristic appearance of this condition but usually shows secondary evidences, such as a drowned lung atelectasis and glandular metastasis. The bronchoscopist usually sees only the primary growth. I believe that in the future better access, possibly by surgical intervention, plus radon implantations and external irradiation will be the only successful procedures in selected cases. Early diagnosis must be obtained. The bronchoscopist must do his part in draining obstructed areas in order to prevent infection and abscess. About the time of Dr. Kernan's first report in 1929, Dr. Jackson and I implanted radon in one pulmonary case. I have assisted Dr. Tucker in other cases since then. The primary results have been gratifying, but I fear the ultimate results will remain unsatisfactory because of lack of access to the entire lesion. Radon seeds should always be implanted under biplane fluoroscopic control in order to make sure that the seeds remain where they were intended to be placed. They are easily displaced in friable cancerous tissue. Bronchial carcinoma, like similar growths elsewhere, must receive an adequate and carefully distributed total dose in order that success may be obtained.

Dr. F. E. Lejeune, New Orleans: Malignant tumors in the bronchi probably act at first as foreign bodies of small size, producing a recurring irritation followed by persistent cough. The history of such a cough, nonproductive at first and persistent in type, should give warning of the possibility of a bronchial new growth. Dr. Kernan has brought out clearly that the successful treatment of carcinoma of the bronchi, as of carcinomas in other parts of the body, depends entirely on an early diagnosis. However, the disease is rarely suspected until far advanced. Bronchoscopic examination will give earlier and more accurate evidence of a pathologic condition in the bronchi than any other method. Once the diagnosis is established, aggressive intrabronchial therapy should be instituted. Electrocoagulation through the bronchoscope, plus the implantation of radon seeds rich in gamma rays, has given me the best results in the few cases coming under my observation. High voltage roentgen therapy is invaluable, and my patients are treated by a competent radiologist. I have not been successful in controlling carcinomas of grade 4, Broders' classification, with high voltage x-rays, as reported by Dr. Kernan. It seems that the best results obtained in treatment of primary bronchial carcinomas are by a combination of electrocoagulation and radon implantation into the growth, accompanied by high voltage roentgen therapy through the affected area and corresponding lymphatic areas. Otolaryngologists know that tumors composed of rapidly multiplying cells, especially those of the

lymphoid group, are highly susceptible to irradiation; to this group belong the angiomas, lymphosarcomas and basal cell epidermoid carcinomas. In this group, radon implantation is highly satisfactory. Dr. Arbuckle has outlined the accepted standard dosage, stating that 1 millicurie of radon during its decay will produce a gamma radiation sufficient to destroy all carcinoma cells within a distance of 0.5 cm. This principle must be followed if implant work is to be successful.

The possibility of late reactions must be borne in mind and particular care exercised to avoid getting radon seeds too close to bone tissue; otherwise a painful, persistent radiation osteitis may result.

Dr. George Taquino, New Orleans: I agree that in the investigation of every obscure symptom complex the bronchoscopist should have a part. I should like to mention Dr. Kernan's case 4. Tumors of leathery consistency often cause constriction of the bronchi; occasionally these are present at the root of the bronchi and may be undiagnosed a long time, often until autopsy. Dr. George Hauser, former pathologist of Charity Hospital, New Orleans, in a case of sudden death caused by hemorrhage, found at autopsy a tumor mass in the lower bronchus about the size of a golf ball, producing sufficient pressure to ulcerate the bronchus and cause hemorrhage and death. Was autopsy obtained in case 5? What conditions were found in the lungs? Was there any metastasis? As to case 7, pedunculated tumors offer the best field for treatment, especially if it is applied well at the base. Most of the tumors are not of this type, however. Case 8 shows a probability of metastasis of both tumors in the lungs. Primary squamous cell carcinoma in the lung is rare. Suppuration and bronchiectasis are frequent, probably because of the nature of tumor growth, and often cause partial or complete obstruction. There is a question as to actual cure until sufficient time has elapsed to prove it. Much of the apparent relief may be due to relief from obstruction in the bronchus, and relief from infection by drainage. Primary malignant disease of the bronchi and lungs is becoming a more and more important problem, because of the apparent increase in its occurrence. Whether this is due to an actual increase in the disease or to improvement in diagnostic methods and more frequent postmortem examinations is not clear. Channing Frothingham reports that in the first ten years of the existence of the Peter Bent Brigham Hospital, from 1913 to 1922, inclusive, the diagnosis of primary carcinoma of the bronchus or lungs was made seven times; in the next five years this diagnosis was made sixteen times, and in the next two years sixteen times. The Charity Hospital, New Orleans, reports that from 1906 to date neoplasms of the lung were diagnosed seventy-seven times, carcinoma of the lung five times, neoplasms of the bronchi nine times and sarcoma with metastasis six times. Of this number, over 70 per cent were made in the last six or seven years and were the direct result of roentgenograms interpreted by Dr. Amédée Granger, chief of the service. The Marine Hospital reports only two cases of carcinoma of the lung since 1924; one was found at autopsy, and in the other the patient was sent home to die.

Dr. G. W. Walker, Fresno, Calif.: A man, about 80 years of age, had had repeated removal of polyps from one nostril for fifteen years by different rhinologists. Biopsy showed no carcinoma. I did a radical ethmoid operation and the Lynch operation on the left frontal sinus. The ethmoid was extensively involved, with some growth seen in the lower part of the rear wall of the frontal sinus. After completion of the operation, I placed four applicators of radium in it and retained them with gauze about the region of the operation. The patient had some osteitis for nearly a month after the operation, after which there was healing of the wound without anything unusual.

DR. JOHN D. KERNAN, New York: Drainage is to be done in the case which showed such extensive bronchiectasis; but the patient is well, even at the present time. Growths in other parts of the body do not generally give such early symptoms. Small carcinomas in the bronchi can produce severe symptoms. The roentgenogram will tend to show a much more extensive lesion than the size of the carcinomatous growth would indicate. I have used diathermy only on those growths which were easily accessible and could be well explored through the bronchoscope. As to the classification of the first case, it did not seem possible that carcinoma of a malignant nature could have existed so long. The pathologist said that it was very vascular and would be sensitive to irradiation. In all cases, I tried to place the radon seeds, as nearly as I could, 1 cm. apart. I did not get an autopsy in case 5. The pathologic description of the slides I had to omit on account of the limitation of time. I did have two cases of squamous cell epithelioma of the bronchus and one that seemed to be a degenerative papilloma. I also had one case of adenocarcinoma.

DR. MILLARD F. ARBUCKLE, St. Louis: Improvement has been made in recent years in the methods employed in diagnosing and treating carcinoma of the lung and the secondary changes and the complications that accompany this disease. Abscess, bronchiectasis and atelectasis, of course, are late signs, but they require treatment. I thank Dr. Pancoast for emphasizing the fact that the secondary changes rather than the carcinoma itself caused the shadow seen in the plate or by fluoroscopy. The matter of duration of cancer of the lung is interesting. The possibility of its having existed as a precancerous lesion, if there is such a lesion, is one that cannot be entirely eliminated from one's mind. All have watched a growth on the vocal cords over a long period when it was apparently benign, only to find at some later date that it had become malignant. One of the earliest symptoms of cancer of the lung is cough, which may exist for a long time without explanation. In such patients a diagnostic bronchoscopy is indicated. A patient whom I now have under treatment has had an unexplained cough for four or five years. A few weeks ago she coughed up a mass of tissue from the windpipe which proved to be carcinomatous. Bronchoscopy revealed that she had a squamous carcinoma of the trachea. In cases of carcinoma of the lung with occlusion of the bronchus by cancer tissue it is possible to remove the obstruction by the use of radon seeds without loss of cartilage. The seeds, of course, are left in the tissues permanently.

BILATERAL ATRESIA OF THE EXTERNAL AUDITORY CANAL WITHOUT MALFORMATION OF THE CONCHA

REPORT OF A CASE WITH SURGICAL RELIEF

BENTON N. COLVER, M.D.
GLENDALE, CALIF.

Cases of marked reduction in hearing due to malformation of both external auditory canals are comparatively rare. This report gives a brief record of such a case, in which gratifying functional results have followed plastic surgical relief of the deformity.

REPORT OF CASE

J. J., a girl, 14 years of age, was born to American missionaries in Hankow, China, and was referred to me by Dr. H. W. Miller of Shanghai, in June, 1930. Her right auricle showed no evidence of an external auditory canal, the left one having a rudimentary canal (fig. 1). Her hearing was markedly impaired. Two younger sisters (aged 11 and 7 years, respectively) were physically normal and had excellent hearing. No developmental anomalies were known to have occurred among the family antecedents. The patient herself had a well proportioned body showing no other deformities. When presented she weighed 109 pounds (49.4 Kg.) and her height was 62 inches (157.5 cm.), and during the year that she was under observation her height increased three fourths of an inch (1.9 cm.) and her weight to 110 pounds (49.9 Kg.). Her basal metabolic rate was plus 6. On Oct. 15, 1930, just preceding operation, the hemoglobin percentage was 66 (Sahli), the red cells numbering 4,080,000 and the white cells 8,500.

The mother stated that the child had been delivered instrumentally; this caused a few bruises behind the right ear and on the neck, as well as a temporary molding irregularity in the shape of the head. Soon after the birth the attending nurse noted the absence of normal auditory canals. The mother said she thought that the right concha was completely smooth, even in the early months, showing no dimple, depression or pit. The infant was taken to Dr. Sloan of Nanking, who stated that there was possibly a membranous diaphragm covering an underlying patulous canal.

Dr. Tatchell, of Hankow, concurring in this opinion, operated on the right ear when the baby was 2 years old. He found the deeper tissues to be solid, with no evidence of a membranous canal. An incision was made deeply toward the middle ear. The passage was firmly packed, but it closed spontaneously in about ten days.

A second surgeon, Dr. Aird, who had seen the patient with Dr. Tatchell previous to the first operation, recognized a difference between the two ears. He noted a minute canal in the left ear, but saw no surface evidence of canal formation in the right ear. Concerning the operation performed by him he wrote: "On dissection (of the right side), I found that there was a bony meatus (canal). A small, hard rubber tube was inserted, but as healing and cicatrization went on, the

tube was expelled and the communication with the interior closed again. As the child was young (3 years old) and the parts were small, I did not find it practicable to line the dissected channel with skin graft."

When the patient was 6 years of age, she was examined roentgenologically by Dr. Dunlap at the Rockefeller Institute (Peiping Medical School). He made the diagnosis of a very small bony canal, and, hoping for the development of a larger canal, advised that no further operation be attempted for a few years.

The third operation was performed by Dr. Miller when the patient was 9 years old. He reported by letter: "We made a posterior incision, exposing the stenosed auditory (bony) canal. In spite of all we could do, the canal gradually filled up." A circular opening was made in the concha to connect with the excavation within. Although the passage was cauterized from time to time and was kept packed, the opening could not be maintained; it closed within three months.

The mother stated that the patient could speak single words at approximately the usual age, but did not learn to form sentences until she was nearly 6 years old. It was necessary to address her in a loud voice. By her association with other children the patient gradually acquired facility in talking and, largely on her own

Fig. 1.—*A*, appearance of the left concha before operation. *B*, rudimentary canal on the left side, exposed by stretching and eversion of the concha.

initiative, developed the art of lip reading. She heard high-pitched, sharp or explosive sounds better than low-pitched and monotonous sounds. She was markedly handicapped in learning Chinese, which requires finer auditory differentiation than does English.

The patient's general health had always been good. The tonsils and adenoids were removed at the age of 9, just before the third operation on the right ear. She never had any earache, though she complained occasionally of tinnitus. She played normally, read, wrote, drew and progressed in her studies as rapidly as opportunity presented. Excellent skill in pantomime and imitation was evidenced. The educational facilities available to her were considerably restricted.

On examination, the right concha showed no evidence of canal formation, but there was a postoperative scar on its smooth surface. This scar seemed to be placed more posteriorly than the position of the small meatus present in the left concha. The canal on the left side was rudimentary, being about 1 mm. in diameter and 19 mm. in depth. A probe used in sounding the canal was met at the depths by firm resistance, which did not seem like that of a drum membrane. The eustachian tubes were also sounded, and shown to be patulous for a normal distance (about 22 mm.). Roentgen examination showed a well developed cellular mastoid

process. The patient spoke with the dull, monotonous voice of the hard of hearing. She was decidedly handicapped in school as well as in personal conversation, but her hearing was supplemented by a fair ability in lip reading.

Functional hearing tests were performed from time to time through the courtesy of Dr. L. D. Trott, who later assisted with the operation, a description of which follows, and who conducted a considerable part of the postoperative care. All but two tests were made on the Jones-Knudsen audio-amplifier, and these were performed through the courtesy of the Graybar Electric Company on their audiometer.

With the Jones-Knudsen audio-amplifier a number of tests were performed, from which only three were selected: The first preceded surgical intervention; the second was performed on the right ear sixteen days after operation, and on the

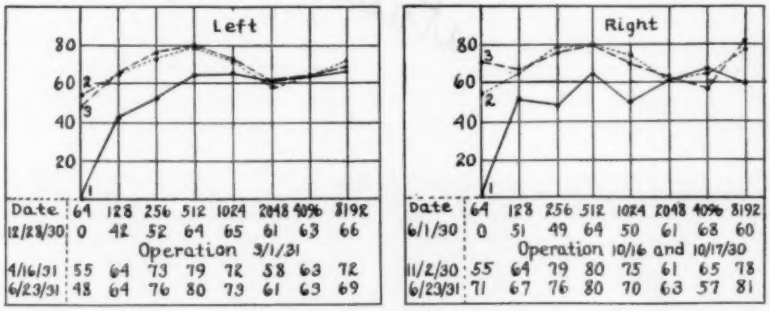

Fig. 2.—Results of hearing tests with the Jones-Knudsen audio-amplifier before and after operation.

Results of Hearing Tests with the Graybar Electric Company Audiometer

		Frequency							
	Date	64	128	256	512	1,024	2,048	4,096	8,192
Right ear	5/ 5/31	10	5	10	15	15	15	25	20
Left ear	2/27/31	30	35	35	40	35	30	15	40
	3/ 1/31	Operation performed							
	5/ 5/31	20	20	20	20	5	20	15	25

left ear forty-six days after operation, and the third was the last test made (fig. 2). The various other tests showed only negligible differences.

Before the operation was performed, each ear showed an upper tone limit of 12,288 double vibrations; after operation the limit was raised to 16,388 double vibrations.

The static labyrinths were tested by turning. After turning to the left, normal nystagmus to the right lasted forty-nine seconds. After turning to the right, normal nystagmus to the left lasted fifty-five seconds.

Bone conduction was tested by a tuning fork, the normal periods of which were: for air conduction, one hundred and thirty seconds; for bone conduction, fifty-five seconds. Previous to operation the right ear responded with 30 seconds for air conduction and one hundred and twenty-five seconds for bone conduction. The left ear responded with twenty-eight seconds for air conduction and one hundred and twenty-four seconds for bone conduction. The right ear following operation responded with: air conduction, seventy seconds; bone conduction, one hundred

and five seconds. Unfortunately these tests were not repeated after convalescence was complete and the canal and tympanum were free from exudate and granulation tissue.

As a normal eustachian tube and mastoid area were demonstrated, and as the static labyrinth responded to turning tests and bone conduction was markedly increased, it was assumed that the middle ear was probably capable of improved

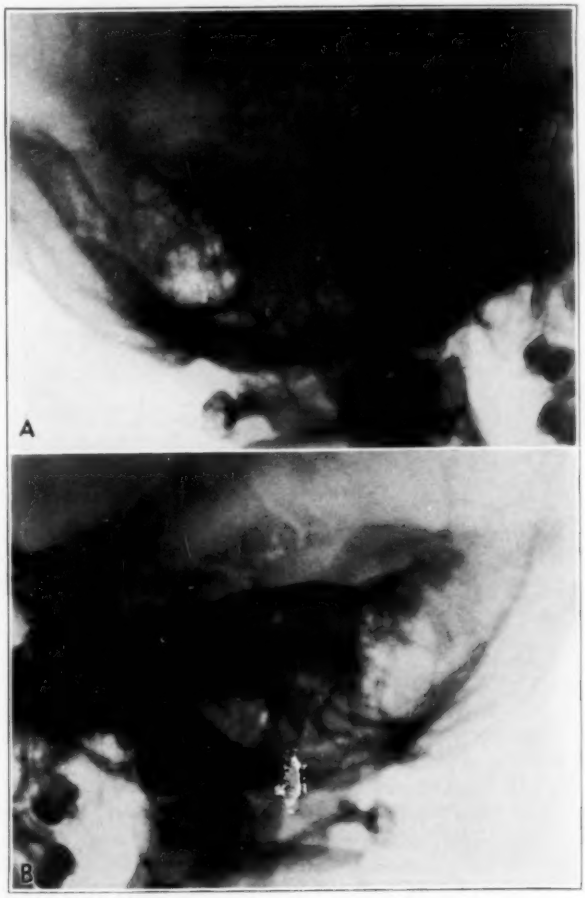

Fig. 3.—*A*, roentgenogram of the right mastoid area, showing normal cellular development and no evidence of a bony canal. *B*, roentgenogram of the left mastoid area, showing a condition similar to that on the right side.

hearing if it could be connected with the external world. Just what would be found in the region of the bony canal after three previous operations was problematic. It was felt that at least an antrotomy could be converted into a fistula giving ingress to air-borne sound waves. Accordingly, an operation on the right ear was performed in two stages on Oct. 16 and 17, 1930.

The operation on the right ear was as follows: A postauricular incision was made just back of the scar of the previous operation. A normal cellular mastoid

area was encountered and excavated (fig. 3). The antrum was small, and, in enlarging it, the dura was exposed through the tegmen antri. Bony dissection was continued forward, opening the attic and exposing the incus. Up to this stage it was believed that the exposed wall of the bony canal was the anterior wall and that the posterior wall had been surgically removed by the previous operations. It now became evident, however, that this assumption was an erroneous one, for the exposed bone was the remnant of the posterior wall, notwithstanding the fact that the ossicles were located well posterior to its plane. The bony posterior wall was then removed. The anterior wall of the bony canal was approximately 3 mm. from the posterior wall, the space between being filled with firm connective tissue. Deeply placed internally, a small membranous sac was seen. It was thought that this might be the wall of the eustachian tube. There was bone extending posteriorly from the sac, with no evidence of an opening or membrane in relation to the middle ear. The operation was discontinued at this stage and the completion of the work postponed till the next day.

In the second stage of the operation a sound was introduced through the eustachian catheter and gently manipulated while the surgical field was inspected. No movement or other evidence of the probe could be noted in relation to the

Fig. 4.—Three views of the incompletely developed and fused incus and malleus found in the right middle ear.

membranous sac at the inner part of the anterior wall of the bony canal. The probe, on the other hand, entered the middle ear and caused a movement of the ossicles. The bony opening into the attic was enlarged downward and forward, without showing any evidence of an annulus or drum membrane. The ossicular mass was seen just within the button-hole opening through the bone. This bony mass was gently delivered and found to be a fusion of the incompletely developed incus and malleus (fig. 4). The membranous sac previously mentioned was now opened and found to be lined with epithelium, to end internally against bone and to extend externally as a small tube, the rudimentary external auditory canal. This membranous tube was split to its blind end just under the skin of the concha. The relation of the canal to the adjacent parts apparently had not been altered by the former operations. It was evident that its anterior position and small caliber had kept it from being involved in any way in the previous surgical work. A large plastic opening, about 12 mm. in diameter, was made in the concha. The split canal was laid open and its sides anchored by suture to the plastic flaps. It furnished a strip of epithelial surface about 3 mm. in width. The rest of the excavation was now lined with a Thiersch graft, the cavity packed and the external postauricular incision closed.

After recovery from the primary operation, many weeks passed before the permanent form of the canal was established. The plastic meatus at first appeared to be almost twice too large, but eventually it contracted to a good size, with a

diameter of about 3 mm. (fig. 5). At the edge of bone around the button-hole into the middle ear, the zone between the epithelium within and the grafted epithelium without tended to form granulations which threatened to obstruct the opening. Only by frequent application of silver nitrate, trichloracetic acid or chromic acid could these granulations be kept under control, until finally an epithelial collar united the epithelium within and without. Eventually the canal became fixed and a permanent free opening into the middle ear was assured. The ear remained dry except for an occasional escape of secretion from the eustachian tube.

When healing was almost complete in the right canal, the patient was examined by Dr. J. MacKenzie Brown. At that time the window in the bone was nearly smooth and the middle ear was dry.

The result was most gratifying clinically, the patient's only complaint in the early weeks being about the loudness of various sounds and noises. She said that she had never known there was so much noise in the world. She was able to hear the ticking of a clock across the room, the teacher speaking at the back of the

Fig. 5.—Postoperative appearance of the right concha, showing the permanent meatus and canal, approximately 3 mm. in diameter.

class room, a person speaking to her through a closed door, a whispered voice and mixed conversation, all of which were formerly inaudible to her. Whether she wished to go through an operation to relieve the condition of the left ear remained an open question for some time. The consideration that finally caused her to decide in favor of further operation was the annoyance of unilateral hearing; she grew weary of localizing everything to her right.

In accordance with her decision a similar operation was performed on the left ear on March 1, 1931. On the basis of the previous exploration of the right ear, it was assumed that the left would reveal an identical malformation. An excavation and antrotomy were performed, the untouched posterior bony wall was removed and dissection carried forward via the iter as in a radical mastoidectomy. Again there was no evidence of any annulus or drum membrane; the external wall of the middle ear was bone. After the removal of this wall, the ossicles were lifted out. This side had an apparently normal incus and malleus, which were not fused as the ossicles had been in the right ear. The membranous canal was found to be of the same size as that on the right side. It ended blindly in a small saccular dilatation against a bony base, and extended externally to the small meatus

already noted. The canal was split, and the plastic flaps were made, forming a slightly smaller meatus than that which had been made on the right. One important

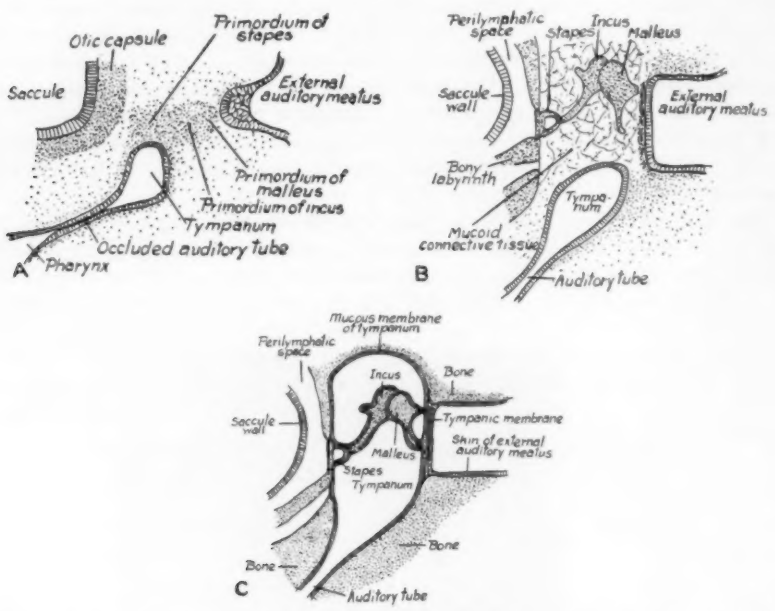

Fig. 6.—*A*, diagrammatic picture of the early stage of development of the internal, middle and external ear. *B*, further progress in the embryologic development. *C*, final stage of normal development of the ear (from Jordan and Kindred: A Textbook of Embryology, London, D. Appleton and Company, 1926).

Fig. 7.—Sketch showing the embryologic fault which resulted in a rudimentary canal and the absence of a tympanic membrane.

detail was added to avoid the annoying experience with granulation tissue at the bony button-hole which had followed the operation on the right ear. The skin grafts were carefully placed as near the edge of the bone as possible, and in this

way the troublesome granulations were reduced to a minimum; final healing resulted in less than half the time required on the right side.

The patient returned to China about five months after the second operation, by which time the clinical improvement was most satisfactory. Her work in school had become a pleasure, she was less nervous, her voice had shown marked improvement incidental to her own auditory appreciation of tone qualities, and a stranger would not have suspected her of any abnormality in hearing. The parents felt that they had observed improvement in hearing attributable to auditory reeducation and to appreciation of conversation and ordinary sounds. After the operation the patient observed a change in the hearing of her own voice. Her speech lost its monotonous characteristics, her voice becoming nearly normal in pitch, timbre and expression.

A letter from Dr. Miller, written in December, 1931, stated that the ears maintained their patulous canals and windows without variation in size. The doctor occasionally observed and wiped away a little frothy secretion, probably coming from the eustachian tube.

CONCLUSIONS

In view of the observations in this case and the results obtained, the following conclusions seem justified.

1. The deformity in these ears was a lack of proper development in the external bony and membranous canals, with a corresponding lack of development of the annulus and tympanic membrane; and secondarily, at least in the right ear, there was a lack of full development of the incus and malleus (fig. 6).

2. The rudimentary membranous canals ended blindly near the eustachian tube but were separated from it by a bony wall (fig. 7).

3. The external wall of the tympanic cavity was entirely bony.

4. It was found feasible to connect the middle ear with the plastic external auditory canal through the medium of a bony window. This is of interest, considering the tendency of the canal epithelium to invade the middle ear through the marginal perforation, and to form cholesteatomatous masses.

5. In planting grafts to effect a junction, it is desirable to place them carefully as close as possible to the epithelial edge, just within the bony window, in order to shorten the period of healing, to minimize the formation of granulations and to insure the maximum size of the resultant opening.

6. It is advisable to remove the incus and malleus, although they may present a normal appearance. They have no apparent functional value in the absence of any tympanic membrane.

7. The question of whether the eustachian tube should be closed in such a case may be answered only after the result of the primary operation is established. After due observation of the success of the plastic operation it would probably be advisable to close the tube, as it can have no valuable function and since it presents a possibility of transmitting secondary infection to the middle ear and is a constant source of moisture.

RÔLE WHICH THE EPIDERMIS PLAYS IN SUPPURATIONS OF THE MIDDLE EAR

JOSEPH G. DRUSS, M.D.
NEW YORK

The epidermis of the tympanic membrane plays a significant rôle in the suppurations of the tympanum and of the mastoid cavity. While its behavior is of paramount importance in the repair of the inflammatory processes of the ear, it is at times a factor in the etiology of suppurations of the middle ear. This opinion is based on a perusal of the literature and a careful study of the histologic material at the laboratory of the Mount Sinai Hospital. The material comprises a series of about one hundred and twenty temporal bones of various ages from embryo to adult life, sectioned serially. As regards the rôle which the epidermis plays in the reparative processes, particular attention was paid to the group of cases in which suppuration of the middle ear was present. These cases total thirty-eight. Some were chronic, some were acute; in some the patients were operated on and in others there was no operative intervention. In eight of these thirty-eight cases an abnormal growth of epidermis was found. As regards the rôle that the epidermis plays in the etiology of suppurations of the middle ear the entire series of temporal bones were studied, but particular attention was given to Shrapnell's membrane. Three of the cases showed changes which might be considered as evidence of this process.

In acute infections of the middle ear following a spontaneous perforation or myringotomy opening, the inflammation usually subsides and the perforation closes within from three to twenty-one days after the onset. As to the reparative process in the closure of the perforation, it may be said briefly that there takes place a proliferation of fibroblasts on the margin of the proprial layer of the drum which soon bridges the gap. The squamous epithelium from the perforation margins grows across the outer surface of the connective tissue bridge as fine flattened out cells, while at the same time the mucous epithelium grows across inside. At times there takes place an overproduction of the fibrous tissue which is seen clinically by otoscopic examination as a white plaque or thickening which may or may not disappear in the course of time.

This process of repair unfortunately does not always take place. While on the one hand the discharge may continue for months or even years before the perforation is healed, on the other hand it may cease temporarily or permanently while the perforation remains patent.

From the Otologic Department of Dr. Friesner and the laboratories of the Mount Sinai Hospital.

The factors responsible for this continued suppuration vary, and a consideration of these is beyond the scope of this paper. Of these factors, the epidermis plays a significant part in the continued suppuration or in the continued patency of the perforation. Not infrequently one finds on histologic sections that the epidermis has grown over the margins of the perforation onto the inner aspect of the tympanic membrane, either replacing the mucosal lining or, more likely, growing on an inflamed surface where the mucosa has been partially or wholly

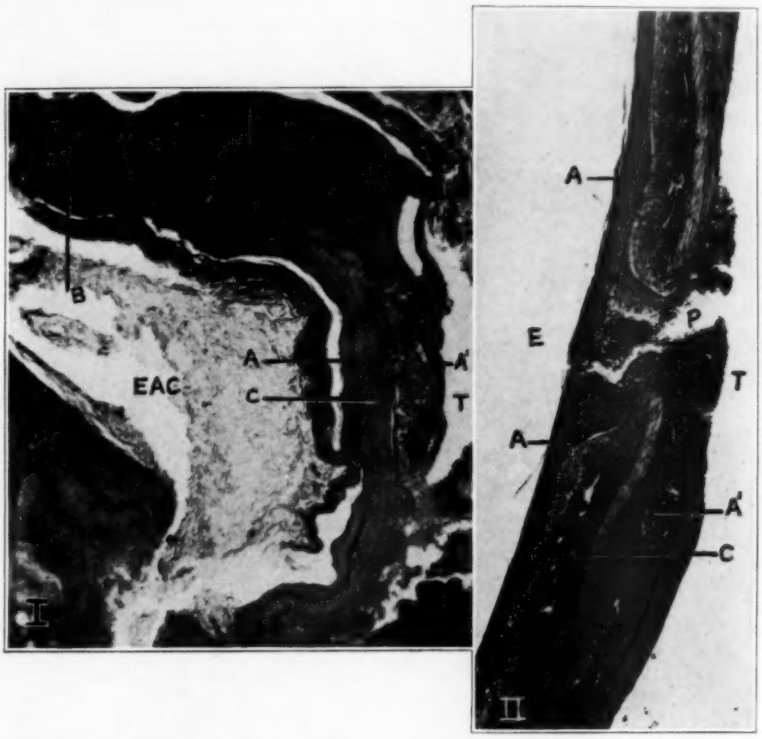

Fig. 1.—*I*. Section through lower portion of the tympanic membrane. The squamous epithelium has grown around the lower margin of the perforation at *B* onto the inner surface of the tympanic membrane. *A* indicates squamous epithelium of the tympanic membrane; *A'*, squamous epithelium on the inner aspect of the tympanic membrane; *C*, proprial layer of the tympanic membrane; *EAC*, external auditory canal, and *T*, tympanic surface. *II*. Same changes as in *I*. *A* indicates squamous epithelium of the tympanic membrane; *A'*, squamous epithelium on the inner aspect of the tympanic membrane; *C*, proprial layer of the drum; *E*, external surface; *P*, perforation of the tympanic membrane, and *T*, tympanic surface. (Sections *I* and *II* were taken from different patients.)

destroyed (fig. 1). The epidermis may grow along the inner aspect of the drum for a considerable distance beyond the margins of the

perforations, depending among other factors on the nature of the mucous membrane.

Also while the ingrowth of the epidermis takes place with central perforations, it is far more frequent with marginal perforations. Scheibe, quoted by Mayer,[1] stated that chronic suppurations of the middle ear with epitympanic perforations are associated with epidermization in about 90 per cent of the cases. Mayer [2] reported two cases which were studied histologically in which epidermization was also present in acute inflammatory processes with perforations in Shrapnell's membrane. Usually the high columnar epithelium in the hypotympanum and in the tubal region of the tympanum offers considerable resistance to its growth. However, one case of chronic suppuration of the middle ear in this series for which a modified radical operation

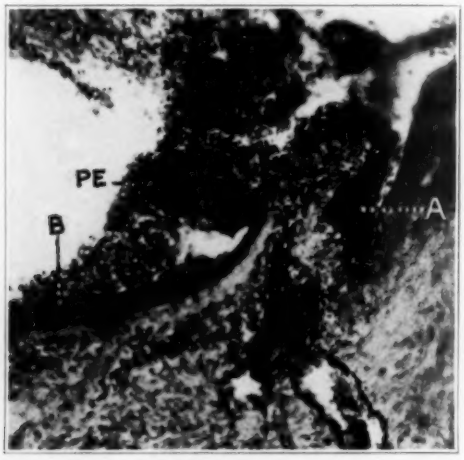

Fig. 2.—Section through the eustachian tube, showing squamous epithelium at *A*. *B* indicates mucous membrane; *PE*, purulent exudate in the eustachian tube.

was done showed, under the microscope, small islands of squamous epithelium in the eustachian tube at a considerable distance from the tympanic orifice (fig. 2). Here the mucosa of the adjacent area was markedly necrotic and was covered with a purulent exudate. The origin of these small localized islands of epidermis is questionable. There was practically no epidermis lining the tympanum, so that it hardly seems likely that it has grown in from the external canal, although the intervening epidermis may have degenerated. The eustachian tube was not curetted; nevertheless it is possible that small particles of epithelial

1. Mayer, Otto, and Beyer, H.: Vierzig Jahre Radikaloperation, Ztschr. f. Hals-, Nasen- u. Ohrenh. **24**:3, 1929.

2. Mayer, Otto: Die Entstehung des Attikcholesteatoms, Acta oto-laryng. **14**:242, 1930.

tissue were forced into the tube and became engrafted on the denuded surface in the course of manipulation at operation or at dressings. Another possibility to be considered is that metaplastic changes might have taken place in the inflamed mucosa.

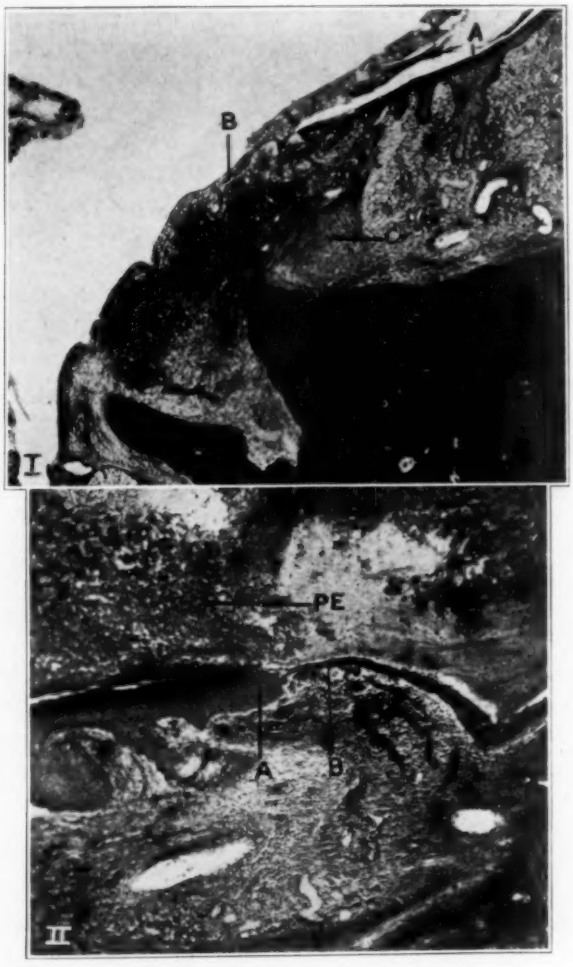

Fig. 3.—The squamous epithelium can be seen growing into the tympanic cavity gradually replacing the diseased mucous membrane: *A*, squamous epithelium; *B*, mucous membrane; *C*, remains of drum membrane (annulus); *PE*, purulent exudate. Sections *I* and *II* were taken from different patients.

This struggle between the mucosa and the epidermis is frequently the cause of suppurations, which may continue for years. Thus the discharge is not always due to bone disease or to an open eustachian

tube, as is frequently stated. The products of excretion of one type of epithelium act as foreign irritants to the other and prolong the discharge (fig. 3).

A perforation the margins of which are covered by squamous epithelium will always remain patent, since the two surfaces will not fuse with each other. The only means whereby a closure can be hoped for is by denuding the margins of the epithelial covering, thus favoring the proliferation of the underlying stratum proprium layer so that the two edges may fuse, allowing the squamous epithelium to grow across and cover the bridged surface. Various methods for closing perforations have been advocated for years. Recently Benesi [3] described a method [4] with which he has been successful in a number of cases. Even if a closure could be accomplished by such procedure, it is questionable whether it should always be instituted, for the following reason: While the newly formed epidermis on the inner aspect of the tympanic membrane or at other locations in the tympanum may degenerate and be replaced by healthy mucous membrane, there is always the possibility that rests of epidermis may remain. These rests may continue to grow and their products of degeneration will accumulate in the tympanum, since means of escape from this cavity have been removed by closing the avenue of exit. As a result, serious complications may ensue.

As is well known, even in the presence of a perforation after the epidermis has grown into the middle ear and antrum it continues to desquamate or shed the dead cells from its matrix. If their means of escape were closed off, their accumulation would cause pressure on the matrix. The matrix, in turn, must expand at the expense of the adjacent structures in spite of the fact that the latter attempts to wall it off as though it were a foreign body. The typical cholesteatoma is thus formed. In its growth it may surround the ossicles, as is demonstrated by figure 4. It is quite apparent that in order for proper drainage to have been established in this case the ossicles would eventually have had to be removed either by operative intervention or by the disease process.

No tissue is free from the destructive process of cholesteatoma, be it connective tissue, bone, dura, or intracranial contents (fig. 5). The exact modus operandi of this procedure is not definitely known. It is believed by some authors [5] that the epidermis plays an active rôle in this process, in that it actually sends strands of cells into the bone which

3. Benesi, O.: Alte Trommelfellperforationen und ihre Behandlung, Monatschr. f. Ohrenh. **66**:27 (Jan.) 1932.

4. The insertion of tampons of boric acid in alcohol at the margins of the perforation.

5. Manasse, Paul: Das Cholesteatom des Mittelohrs beziehungsweise des Felsenbeins, in Körner: Die Ohrenheilkunde der Gegenwart und ihre Grenzgebiete, Wiesbaden, J. F. Bergmann, 1917, p. 64.

Fig. 4.—Vertical sections through the attic. *I.* This shows the cholesteatoma surrounding the malleus: *A,* cholesteatoma; *EAC,* external auditory canal; *ESC,* external semicircular canal; *F,* facial nerve, and *M,* malleus. *II.* This section shows the cholesteatoma growing in through a perforation in the attic at *P* and surrounding the ossicles: *A,* cholesteatoma; *EAC,* external auditory canal; *ESC,* external semicircular canal; *F,* facial nerve; *M,* malleus; *St,* stapedius muscle; *T,* tympanum, and *TM,* tympanic membrane. Sections *I* and *II* were taken from different patients.

break it down. Others believe that the bone is destroyed by connective tissue (osteitis rareficans). Still others believe that it is destroyed by the chemical action of the cholesteatoma. Hence there are undoubtedly biologic factors responsible for this expansive growth besides actual pressure from within the tumor. During this growth of the cholesteatoma the perforation of the tympanum may enlarge at the expense of the latter or at the expense of the outer attic or posterior canal wall. Better drainage for the products of desquamation is thus permitted. Nevertheless, even with an enlarged perforation when drainage is ade-

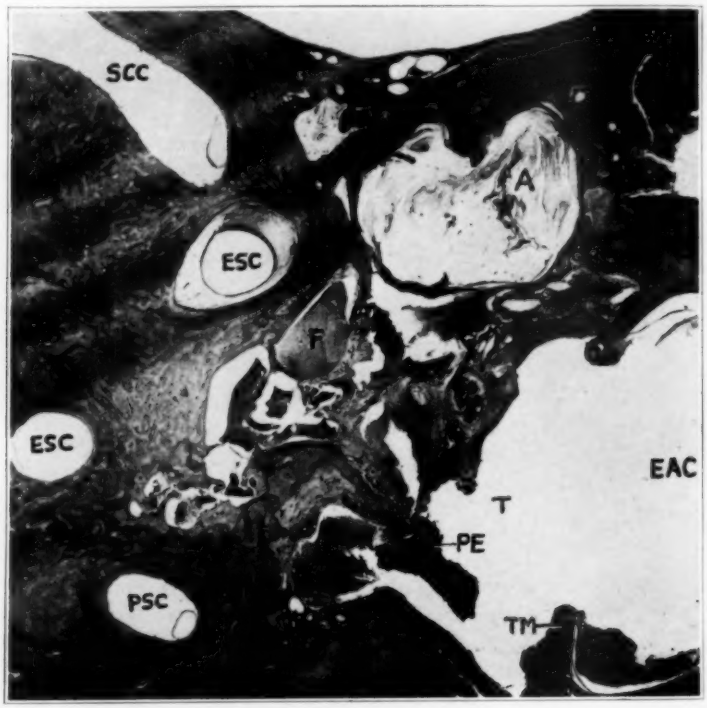

Fig. 5.—Vertical section through the aditus, showing the huge cholesteatoma in this cavity: *A*, cholesteatoma in the aditus; *EAC*, external auditory canal; *ESC*, external semicircular canal; *F*, facial nerve; *PE*, purulent exudate; *PSC*, posterior semicircular canal; *SCC*, superior semicircular canal; *T*, tympanum, and *TM*, tympanic membrane.

quate the matrix may continue to grow and involve the intracranial contents.

While the growth of the epidermis takes place beyond the margin of the perforation in a number of cases, in others this process does not obtain. Instead the epidermis stops at the margin, where it meets the approaching mucous membrane from the inner aspect of the drum. A thickening at this site sometimes takes place which is the result of a

proliferation of connective tissue from the proprial layer of the drum. Or a polyp may be formed at this site, lined either by mucous membrane, by transitional epithelium or by stratified squamous epithelium (fig. 6 *I*). This polyp may extend into the middle ear or into the

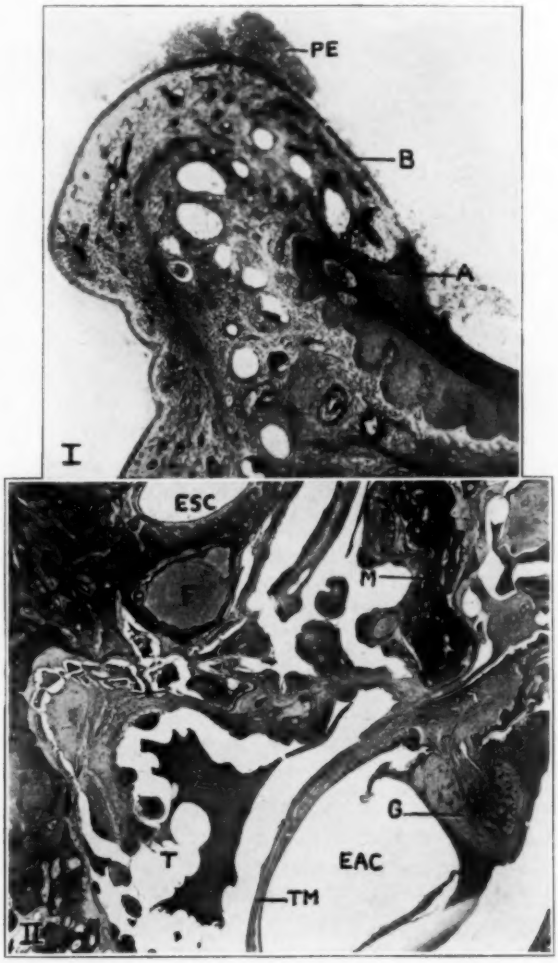

Fig. 6.—*I*. Granuloma lined partially by squamous epithelium and partially by cuboidal cells (diseased). The latter is being replaced by the former. *A* indicates squamous epithelium; *B*, cuboidal epithelium, and *PE*, purulent exudate. *II*. Vertical section through the tympanum, showing a granuloma in the external auditory canal, springing from Shrapnell's membrane. *EAC*, external auditory canal; *ESC*, external semicircular canal; *F*, facial nerve; *G*, granuloma; *M*, malleus; *T*, tympanum, and *TM*, tympanic membrane.

external canal, partially or totally obliterating the perforation (fig. 6 *II*). Strands of epidermis are not infrequently seen extending into the sub-

stance of the polyp from the surface. Seldom does one find that the mucosa of the drum has grown around the margin of the perforation to gain a foothold for any length of time on its outer aspect. Usually the mucous membrane thus exposed to the outside world will eventually either degenerate and be replaced by squamous epithelium or undergo a type of metaplasia and change to a transitional epithelium. The two latter types of epithelia are more resistant to the outside elements.

All other factors being equal, it is obvious that this ingrowth of epidermis into the middle ear will be more prevalent in cases with multiple perforations such as are present in tuberculosis. In two cases of the present series in which there was an ingrowth of epidermis into the middle ear there were double perforations. One of these patients was tuberculous (fig. 7).

As was mentioned previously, the anatomic and pathologic conditions of the mucous membrane lining the tympanum are important factors for the ingrowth of the epidermis into the cavity. Normal mucous membrane, particularly the columnar type, offers strong resistance to the invading epidermis. It is questionable whether normal mucosa could be replaced by epidermis. In marked suppuration of the tympanum when the mucosa is necrotic en masse over large areas and when a good portion of the drum is destroyed, as in scarlet fever, tuberculosis or diabetes, a good opportunity for the ingrowth of epidermis is afforded. This is particularly true in those cases in which hyperplastic mucosa or a considerable amount of granulation tissue is present in the tympanum and in which a connective tissue bridge in the reparative process of the suppuration of the middle ear has been formed (fig. 7). As the epidermis invades the tympanic cavity in the attempt to line the newly formed margin of the cavity, it sends long strands of epidermal cells into the submucosa. This struggle between the epidermis and mucous membrane is really nature's attempt to heal over a suppurative cavity. The epidermis is usually the victor (fig. 8 *I*). In a certain percentage of cases the greater portion of the tympanum is epidermized, as in a radical operation, and a relative cure is obtained without any operative intervention. It may be of interest at this point to demonstrate a case in which the epidermis invaded the proprial layer of the tympanic membrane and arranged itself in concentric layers in the typical cholesteatomatous manner (fig. 8 *II*). When the submucosa is loose and vascular, it offers a better foothold for the approaching epidermis than does a tissue which is dense and relatively poor in blood supply. Usually the greatest amount of contraction of the granulation tissue and of the denuded submucosa takes place after they have been covered by the epidermis (Brunner [6]).

6. Brunner, H.: Ueber das Verhalten der Mittelohrschleimhaut nach Radikaloperation, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **128**:28, 1931.

The epidermization is not necessarily limited to the tympanum, but may extend into the attic and antrum if these cavities are not obliterated and if they communicate with it (fig. 5). This epidermization of the antrum seldom, if ever, takes place in pneumatic mastoids on which no

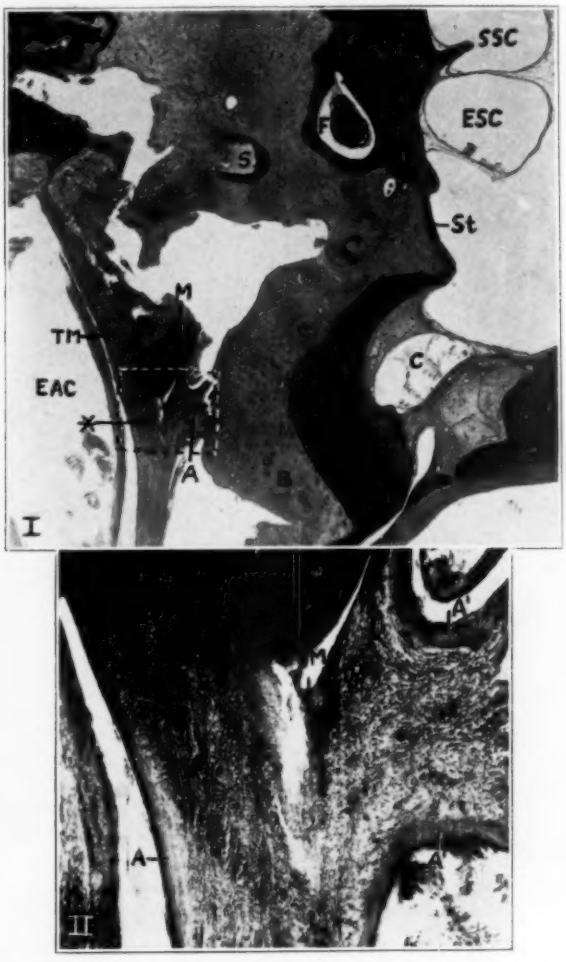

Fig. 7.—*I.* Section through the tympanum, showing the growth of epithelium across connective tissue bridge at *A* onto the inner aspect of the tympanic membrane and onto the inner tympanic wall. This growth has taken place through a perforation. (This is a case of tuberculosis of the middle ear. The tubercles can be seen scattered throughout the mucosa.) *B* indicates mucosa, inflamed and containing tubercles; *C*, cochlea; *EAC*, external auditory canal; *ESC*, external semicircular canal; *F*, facial nerve, *M*, malleus; *S*, sequestrum of an ossicle; *SSC*, superior semicircular canal; *St*, stapes, and *TM*, tympanic membrane. *II.* Higher magnification of *I* at *, showing growth of squamous epithelium at *A'* *A* indicates squamous epithelium on the outer aspect of the tympanic membrane; *M*, malleus.

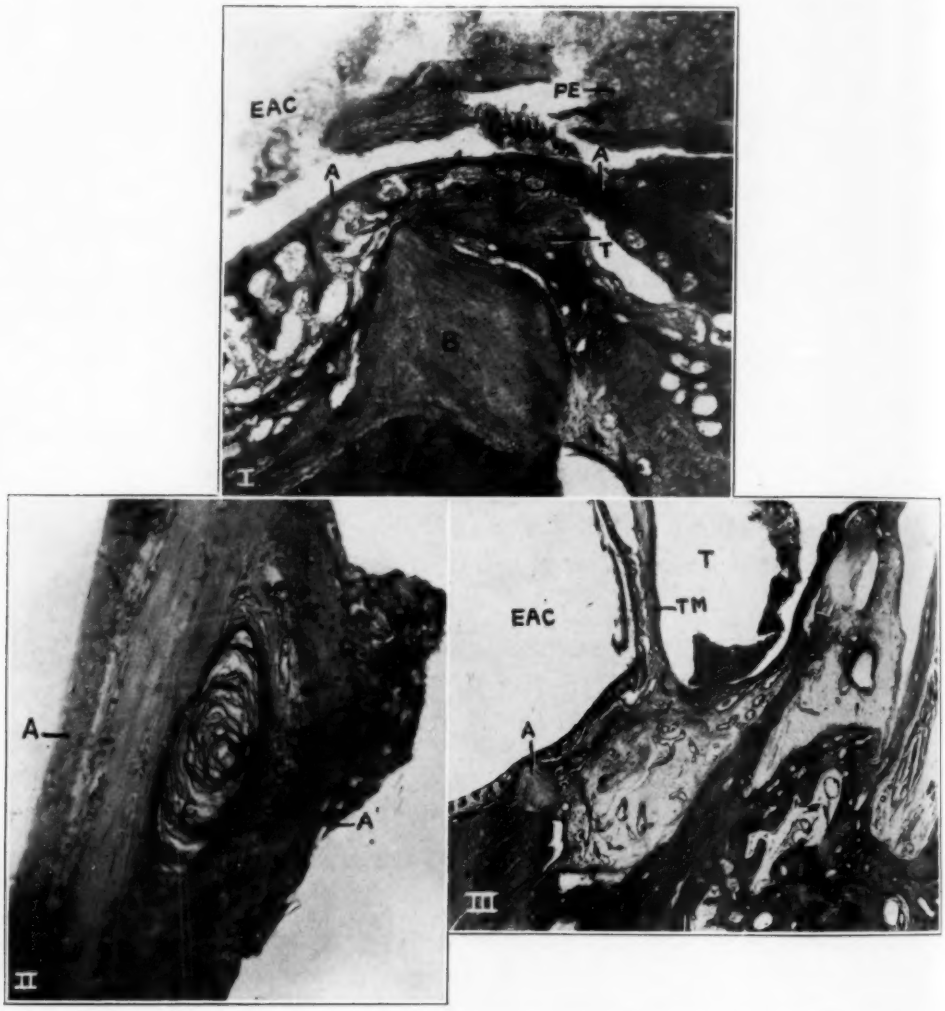

Fig. 8.—*I*. Section through the lower part of the external canal and tympanum, showing the growth of epidermis across the margin of perforation into the tympanum. The remains of the tympanic membrane are pushed inward and downward into the tympanum. *A* indicates epidermis of the external auditory canal growing in to line the tympanic cavity; *B*, annulus tympanicus; *EAC*, external auditory canal; *PE*, purulent exudate, and *T*, remains of the tympanic membrane. *II*. Cholesteatoma of the tympanic membrane. *A* indicates squamous epithelium on the outer aspect; *A'*, squamous epithelium on the inner aspect; *C*, cholesteatoma. *III*. Vertical section through the lower part of the tympanum, showing marked narrowing of the tympanic cavity by change in position of the tympanic membrane. *A* indicates annulus tympanicus, the former site of the tympanic membrane; *EAC*, external auditory canal; *T*, tympanic cavity, and *TM*, tympanic membrane.

operation has been performed, since the infection present in the tympanum usually involves the mastoid cells and an acute mastoiditis results, as is stated by Almour.[7] It is usually found in sclerotic mastoids and in those cases in which a simple mastoidectomy was performed. The epidermis grows not only over bony structures but also over dura or sinus (Gerber [8]) exposed at operation or exposed by the disease process.

As is well known, living cells have a great tendency to regenerate and multiply. This is particularly true of the various epithelia lining the body when they are called on to cover a denuded area. The same condition holds for the mucosa lining the tympanic cavity. The only difference here is that at times a lining that is foreign to this area takes part in the procedure.

In certain cases of suppuration of the middle ear, particularly with large perforations, the tendency of the epidermis to grow around the margins of the perforations is so great that in this process the remainder of the drum is pushed inward and is more or less flattened out in the tympanum (Brunner [6]). One of the cases in this series illustrates this point vividly. Here on histologic study it was seen that the remnant of the drum was forced downward and inward by the invading epidermis and a new drum membrane lined by squamous epithelium was produced at a considerable distance inward from the site of the original one, thus narrowing the tympanic cavity (fig. 8 *III*).

This, again, is the same reparative process previously mentioned and it is this principle which is utilized in the healing following radical mastoidectomy with or without the aid of skin flaps. In the radical operation it is hoped that the middle ear and antrum will be epidermized. This ideal condition, however, is not always realized. The factors responsible for epidermization vary. However, the anatomic and pathologic condition of the mucous membrane and underlying bone is most important. Thus, as was already mentioned, bridges of connective tissue are frequently produced which divide the tympanic cavity into two or more divisions. These may be lined either by mucous membrane or by epidermis. Usually the outer surface of the bridge or false membrane is lined by epidermis whereas the inner surface is lined by mucous membrane. The areas which most frequently retain their mucosal lining are the region of the eustachian tube, the hypotympanum and the niche of the round window. It is technically difficult to remove all the mucous membrane of the tympanic cavity or of the eustachian tube at

7. Almour, R.: Significance of the Squamous Epithelium in the Cause and Repair of Chronic Suppurating Middle Ear Disease, Collected Papers of the Otolaryngologic Clinic, Beth Israel Hospital, New York, bulletin no. 4, 1930.

8. Gerber, quoted by Reinking, F.: Ueber die Ausbreitung des Schleimhaut-Epithels auf die Wundflächen nach Operationen am Mittelohr, Ztschr. f. Ohrenh. **54**:311, 1907.

operation, since in the former the niche cannot be reached while in the latter the furrows or crevices are so minute that with instrumentation they are inaccessible. Nor is it advisable to attempt to remove all the mucosa, in view of the danger associated with it, e. g., dislocation of the stapes and injury to the facial nerve. Also various methods of closure of the eustachian tube in the radical mastoid operation have been advocated and instituted with varying results. It seems to me, however, that these methods or even the simple procedure of curetting the tube is superfluous, since in most of the cases healing occurs without such intervention. The diseased mucosa regenerates rapidly. The eustachian tube remains open, is bridged across by connective tissue bands at its tympanic orifice or is closed by granulations. An open eustachian tube does not mean a discharging middle ear.

The question as to the ultimate fate of the mucous membrane in the tympanum has been partially answered. It may degenerate and be replaced by invading epidermis; it may regenerate and continue to secrete, the products of secretion making their exit through the tube into the nasal cavity when its tympanic orifice is closed off from the outside world by means of a connective tissue bridge. It may undergo metaplastic changes. It may form cysts, where it remains in a state of inactivity for a period of years. As in the eustachian tube, the presence of mucous membrane in the tympanum does not mean a discharging ear.

As the epidermis grows into the middle ear in the attempt to line these cavities it may cover granulations, varying in thickness. It will never grow over bare bone; a bed of connective tissue must be present to serve as a basement membrane. When the bone is smooth and healthy, as after the performance of a radical operation, the granulations produced on it are usually thin. After the epidermis has grown over this healthy granulation tissue, it assumes a white glistening appearance. If, on the other hand, the bone is diseased or if the granulations are exuberant, while the epidermis may spread over them, it will not have a healthy glistening appearance. This is due to the fact that the subepidermal tissue will be considerably thickened.[9] The subepidermal tissue may contract down in time if the diseased process within it or in the underlying bone subsides. The entire cavity will thus be lined by a smooth layer of epidermis, the subepidermal tissue filling in the various crevices and bays.

The appearance of the epidermis is not always a criterion as to the condition of the underlying structures. At times the epidermis appears healthy, while beneath it there may be rests of mucous membrane in the form of cysts which, as was mentioned formerly, have been quiescent for a number of years, only to be reactivated by infection.

9. Zeroni: Beitrag zur Kenntnis der Heilungsvorgänge nach der operativen Freilegung der Mittelohrräume, Arch. f. Ohrenh. **45**:171, 1898.

As a result, the adjacent bone and finally the more vital structures may become involved. It is quite possible, as Neumann [10] and Fabry [11] pointed out, that there is activity going on continually beneath the epidermis, even though it appears dry and healed. With an acute exacerbation, an intracranial complication may ensue. It is for this reason that these patients in whom the middle ear or antrum or both have been epidermized, with or without the intervention of radical mastoidectomy, must always be under close observation for an acute exacerbation. Among the group of cases studied histologically, two were noted

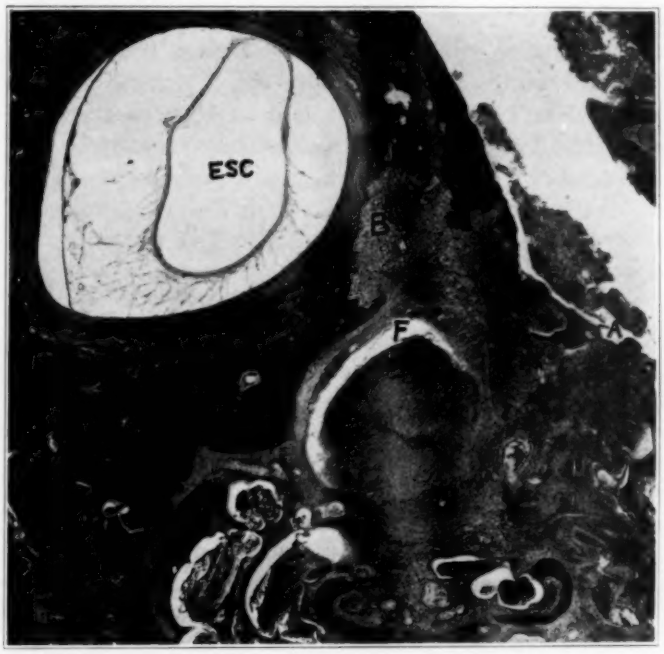

Fig. 9.—Photomicrograph showing the growth of squamous epithelium on the inner tympanic wall, while beneath it the destructive process of the bony labyrinth is going on. A good part of the facial canal has been destroyed. *A* indicates squamous epithelium; *B*, necrosis of the bony labyrinth; *ESC*, external semicircular canal; *F*, facial nerve, and *T*, tympanum.

in which the epidermis had grown over and practically lined the inner tympanic wall while beneath it there was evidence of active inflammatory changes, i. e., marked cellular infiltration in the subepidermal tissue, the presence of infected cysts and partial destruction of the

10. Neumann, H.: Zur Klinik und Pathologie alter Radikaloperationsholen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **24**:379, 1929.

11. Fabry, F.: Uber Cholesteatomrezidive nach Radikaloperation, Ztschr. f. Ohrenh. **81**:169, 1921.

facial canal by osteoclasts, exposing the facial nerve (fig. 9). Zeroni [9] also described two cases following radical operations which showed similar inflammatory changes beneath the epidermis.

The great majority of secondary infections after epidermization has taken place arise in the subepidermal structures which break through the epidermis. In a few cases infection may enter from the outside by means of abrasions of the epidermis. It is well known that the epidermis serves as one of the greatest protective agents of the body. Recently I saw a case in which a radical mastoidectomy was performed on a man twenty-four years earlier. He came for some nasal condition, and on routine examination of the ear a large piece of packing was removed from the external canal. It was noticed that the packing was somewhat moistened by purulent exudate which produced a most nauseating stench. The patient maintained that the packing had been there since treatment following a radical mastoidectomy twenty-four years before. Yet, much to my surprise, on inspecting the aural cavity I found it to be well epithelized and glistening. The patient was seen on subsequent visits, but there was no discharge from the ear. Here, in spite of prolonged contact of infectious material with the epidermis, there was no evidence of apparent invasion.

That the epidermis of the drum plays an important rôle in the etiology of suppurations of the middle ear has been well established. This applies particularly to those cases in which spontaneous perforation in Shrapnell's membrane is present (Mayer [2]). Primary cholesteatoma may be differentiated from secondary cholesteatoma in that the former is not preceded by an infectious process. Not infrequently one finds, on otoscopic examination, a perforation in Shrapnell's membrane from which there is usually a foul-smelling purulent discharge. The remainder of the drum appears relatively normal. The patient denies having had any otitic infections. From the character of the discharge and site of perforation a diagnosis of cholesteatoma is made. What are the etiologic factors responsible for this condition? The exact modus operandi of this abnormal epidermal growth is not definitely known, and the explanations offered are based on theoretical grounds.

Wittmaack [12] and Bezold [13] maintain that in these cases the attic and antrum have been previously separated or closed off by means of fibrotic bands. As a result, the negative pressure produced in the former cavities causes an invagination of the epidermis of the superior part of the drum. The invagination gradually increases until it finally ruptures and a perforation is produced. Secondary infection takes place,

12. Wittmaack, K.: Zur Frage der Bedeutung der Mittelohrentzündungen des frühesten Kindesalters für Später, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **129**:3, 1931.

13. Bezold, quoted by Albrecht, W.: Zur Pathogenese des Mittelohrcholesteatoms, Acta oto-laryng. **15**:375, 1931.

the mucosa lining the antrum and attic is destroyed and the epidermis which grows in from the margins of the perforation lines the cavity. The secondary infection acts as a stimulant for the epidermal growth.

It is believed by some authors that the epidermis can make considerable progress in its growth after the invagination of the epidermis takes place, but before the mucous membrane ruptures. This may account for the absence of any signs and symptoms over the extended length of time. However, Albrecht maintains:

> . . . if the mucous membrane is intact, it offers considerable resistance to the growth of the epidermis. In reality it must be classified as cholesteatoma of the external canal and not of the middle ear. Only when the mucous membrane of the tympanic cavity is destroyed and is replaced by connective tissue which serves as a ground substance for the growth of epidermis can it be called cholesteatoma of the middle ear.

Steurer,[14] Albrecht [15] and others (Berberich Lange [16]) believe that a separation of the antrum and attic from the tympanum is not prerequisite for this invagination of the epidermis. They are of the opinion that the invagination may result from the contraction of connective tissue or the remains of embryonal tissue in the attic. However, there may be active proliferation of epidermal cells which invade the subepidermal tissue in Shrapnell's membrane in the form of long strands. They further maintain that there is a "local anatomic disposition or relationship" of the epidermis in this region which is the basis for the atypical growth. They emphasize the importance of the presence of embryonal tissue in the attic, at which site the epidermis lies directly over it. While this embryonic tissue is present in about 43 per cent of the new-born (Schwarz [17]), it may be present at any age. In its recession it usually disappears last from the attic.

The other contributing factors to the growth of the epidermis are: (1) local conditions, e. g., (*a*) external irritation or stimulation, (*b*) diminished resistance of the subepidermal tissue and (*c*) catarrhal involvement of the middle ear; (2) the general constitutional make-up of the patient (Schwarz [18]).

In passing, the metaplastic theory sponsored by Wendt, Politzer and Uffenorde (Manasse [5]) should be mentioned. These authors maintain

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14. Steurer: Zur Pathogenese der Mittelohrcholesteatome, Ztschr. f. Hals-, Nasen- u. Ohrenh. **24**:402, 1929.

15. Albrecht, W.: Ueber Konstitutionsprobleme in der Pathogenese der Hals-, Nasen und Ohrenkrankheiten, Ztschr. f. Hals-, Nasen- u. Ohrenh. **29**:18 (May) 1931.

16. Lange, Berberich, quoted by Mayer.[2]

17. Schwarz, quoted by Albrecht.[15]

18. Schwarz, M.: Die Einsenkung der Shrapnellschen Membran und ihre klinische Bedeutung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **131**:16 (April) 1932.

Fig. 10.—Different stages of invagination of the epidermis into the attic at *A*. *EAC* indicates external auditory canal; *I*, incus, and *M*, malleus.

that the mucous membrane of the middle ear and attic, as a result of an inflammatory desquamative process, undergoes a type of metaplasia in which the epidermis is produced.

In an effort to obtain added evidence regarding the theories just outlined (i. e., the rôle that the epidermis plays in the etiology of suppurations of the middle ear), a careful study of Shrapnell's membrane was made in the entire series of one hundred and twenty temporal bones.

Only three patients in this series showed the invagination of the epidermis in Shrapnell's membrane (fig. 10). The ages of these were 3 weeks, 5 years and 12 years respectively. In none could a closing off of the attic and antrum from the tympanum be demonstrated from the histologic sections. Only in the 3 weeks old infant was embryonic tissue present in the attic. There was no infectious process in the middle ear. In the other two cases, however, no embryonic tissue was present, but the mucosa of the attic was considerably thickened and inflamed as a result of a previous infectious process. Whether or not the invagination of epidermis would have continued until eventually perforation would have taken place, it is difficult to postulate. The photomicrographs presented in Steurer's article, showing a perforation to have actually taken place, are indeed convincing as to this possibility. It is fully realized that in the last two cases of this series the resulting epidermal growth could not be considered primary in the true sense of the term, since there was evidence of previous infection of the middle ear. None of the cases showed a metaplasia of the mucous membrane to epidermis. Thus, while invagination of the epidermis does take place and while it may play a rôle in the cause of suppuration of the middle ear, the factors responsible for it are not definitely known.

SUMMARY AND CONCLUSIONS

A review of the literature and a study in serial sections of one hundred and twenty temporal bones were made in an effort to show the rôle that the epidermis plays in the repair and in the etiology of suppurations of the middle ear. The repair of the perforations in the usual acute cases and the associated factors responsible for chronic suppurations and continued patency of the tympanic membrane are considered. The various theories regarding the cause of primary cholesteatoma and spontaneous perforations with their formation are discussed. Reasons for the inadvisability of attempting to close off tympanic perforations by artificial means are given. Curetting of the eustachian tube in the radical mastoid operation is not an essential feature

The variety of therapeutic measures advocated for chronic suppurations of the middle ear, from the ultraconservative, such as dry cleansing and the use of drops and iodine powder, to the most radical

procedure, such as the radical mastoidectomy—the ossiculectomy for attic drainage standing between—are well known. The sponsors for each method claim good results; consequently there are cases which are suitable for each type of therapy. Each case is a problem in itself. In a large percentage of cases, nature succeeds in repairing the infectious process, in some of these by her own peculiar method ("nature's radical") without any operative intervention. To quote Dr. Friesner: "A radical mastoidectomy is indicated only when the otitic condition is a source of imminent danger to the life of the patient." Finally it must be borne in mind that not only patients with suppurations of the middle ear but those who are apparently cured with or without any operative intervention should be under close observation for the onset of further symptoms. The appearance of the epidermized tympanic cavity is not always a criterion as to the condition of the underlying structures.

THE GENETIC FACTOR IN OTOSCLEROSIS

CHARLES B. DAVENPORT, PH.D.

BESS LLOYD MILLES, PH.D.

AND

LILLIAN B. FRINK, M.A.

COLD SPRING HARBOR, N. Y.

(Concluded from page 383)

PART III. GENERAL

A. COMMENT

1. *Probability that the Hypothesis Favored Gives a True Picture of the Facts.*—We have tested the hypothesis that otosclerosis depends on the concurrence in the zygote of a dominant gene in the X-chromosome and a dominant gene in an A-chromosome. We have seen that, on this hypothesis, all cases of occurrence of otosclerosis can be accounted for, and approximately the percentage of affected individuals found in a fraternity is that expected from the hypothesis. We have now to consider the probability that this hypothesis meets all the tests that can be applied to it.

(*a*) Relative Proportion of the Two Sexes Affected: We have seen that in the otosclerotic adults of our series the proportion of affected males to females is as 100:185. Thus, among otosclerotic persons the proportion of females is almost double that of males.

By hypothesis, all affected individuals are derived from a zygote that carries an affected X-chromosome (as well as an affected A-chromosome).

All affected males can carry only 1 affected X-chromosome, since they have only 1 X-chromosome of any sort, and this affected X-chromosome comes from the egg.

All affected females carry an affected X-chromosome, but they may carry 2 affected X-chromosomes; however, the latter case is relatively rare.

There is no reason to doubt that the proportion of affected X-chromosomes is constant, whether in the population of males or in that of females.

The female zygote has the same chance as the male of getting an X-chromosome from the egg. About half of the female otosclerotics have received their affected X-chromosome from the egg; the other half have received their affected X-chromosome from the sperm.

Hence, we should expect twice as many zygotes carrying an affected X-chromosome in the females as the males—and this agrees closely with observation.

The consideration of proportions of the sexes shows that some of the other hypotheses are impossible. Thus on hypothesis 4, if otosclerotic males constitute 6 in 10,000 of the population, otosclerotic females should constitute the square of that fraction or 36 in 1,000,000, which is obviously false.

(*b*) An Attempt to Assign a Rôle to the Respective Genes: Modern genetics seeks not only to discover the number of genes chiefly responsible for special control of development but also to find just how they exercise that control. Since the experimental method is not readily applicable to man, we may resort to an attempt at analyzing the situation by weighing probabilities.

An obvious rôle of one of the genes responsible for otosclerosis is to modify the ordinary osteogenic processes, especially in the petrous portion of the temporal bone. Normally, the osteogenic processes are fairly well finished at puberty, although always available for repair or in response to special demands of the body. In the otosclerotic person, on the other hand, there seems to be a revival, at a late stage, of the processes by which fibrous connective tissue and cartilage become transformed into bone, so that tissues that are normally finished in childhood undergo further metamorphoses. Thus, membranes like that surrounding the foot of the stapes become ossified, and a general hyperostosis of the wall of the vestibule, and sometimes of other parts of the temporal bone, occurs. The abnormal osteogenic processes may, indeed, show themselves in infancy, and are probably operating during the embryonic period. Thus the long bones may develop in atypical fashion and a tendency toward brittle bones appear.

This atypical osteogenesis is found equally in both sexes. The gene that is responsible for it is probably in an autosome. Its presence modifies the reaction of the mesenchyme and especially the osteoclasts and osteoblasts.

The second gene seems to be one that acts differentially between the sexes. It increases, in some way, the incidence of the defect in the female and makes its effect more marked at puberty. It also leads to a further tissue change during pregnancy. This gene is, by hypothesis, located in the X-chromosome. It is more affected in the female than in the male because the X-chromosome is double in the former and single in the latter. This gene is suspected of being responsible for the abnormal calcium metabolism which many authors have found in otosclerotics.[51] Perhaps it is partly because pregnant women make greater

51. Duel, A. B.: Otosclerosis, New York, Paul B. Hoeber, Inc., 1929 (index of subjects, under "Calcium of blood," especially pp. 388 [Kopetsky] and 389 [Leicher]).

demands on their blood calcium, and because, owing to the 2 X-chromosomes, their supply of blood calcium is especially small, that otosclerotic pregnant women suffer from the calcium deficiency more than other people.

In attempting, thus, to show the nature of the specific defects introduced into development by the 2 genes responsible for otosclerosis, it is not to be held that these are the only changes induced. Modern genetics recognizes that the modification of 1 gene produces generalized changes as well as specific ones. However, this fact still makes it possible to find the primary change involved.

(*c*) Are There Various Genetic Entities Passing Under the Name of Otosclerosis? It is well known that many clinical entities are not genetic entities. Such clinical entities—like myopia—may have quite an unlike inheritance in different families. Is this true of otosclerosis? A survey of the pedigrees does, indeed, show some cases in which the genetics would be satisfied by the hypothesis of simple dominance. It was the consideration of such cases that led Albrecht to conclude that a simple dominant factor was responsible in general. That hypothesis is quite inadequate for most cases, because of skipping of generations. And it is not necessary for any, for all such cases can be explained by the hypothesis of 2 dominant factors.

In addition to the possibility of lines of otosclerosis that are due to quite different genes, there is to be considered the presence of distinct biotypes—strains carrying some modifying factor that gives a special aspect to the course of the disease. For example, there are early and late biotypes. Thus, in family 1 hardness of hearing was first noticed in the affected children at 8, 7 and 18 years and in the mother (so far as recalled) at about 21 years. On the other hand in family c (Addendum) the otosclerosis first appeared in the affected children at 30, 25, 30, 36, 35 and 24 years. This is a family of Polish Jews.

Again, the progress of the disease shows a diverse history in different families. Thus, in family 27, mother and daughter became totally deaf, the daughter at 40 years. Also, in family 29 the mother became totally deaf, as did one of her brothers and their mother, in turn. In family 29 the father is severely deaf; his mother became totally deaf and his son is totally deaf.

On the other hand, the disease sometimes progresses very slowly. In family 33 child 1 has a hardly noticeable deafness. Child 4 apparently is affected chiefly in certain tones. Child 5 has a slight deafness. Child 6 (twin of child 5) has a similar hardness of hearing, first noticed at 27 years. These biotypes do not indicate new types of inheritance, but only slight mutations of the genes involved in typical otosclerosis. In man, as in other species, all genes are subject to mutation, a process going on all the time. The wonder is, indeed, that any developmental

disorder, like otosclerosis, should remain so similar in diverse countries over a long period of time. Nevertheless, the facts lend themselves to the interpretation that there is a large central group of cases of otosclerosis characterized by a definite genetic constitution, which has become widespread through our population, in Nordics, Mediterraneans and Jews. For that group the hypothesis to which we have been led seems to hold.

At the same time, it may be said that our hypothesis is the simplest one that will meet the genetic requirements of the commonest type of otosclerosis. It may well be that in some human blood lines additional factors are involved in otosclerosis, but, in view of the limitations of human genetics, it will be difficult to demonstrate their presence.

2. *Constitutional Abnormalities Associated with Otosclerosis.*—There are few cases in which a single gene is modified that do not involve a change of more than a single organ in the body. We have, therefore, in considering otosclerosis, to look for other changes in constitution. The existence of bony overgrowth, such that even long bones of the appendages are modified, has already been referred to. Other investigators, especially Bauer and Stein, have looked for other constitutional abnormalities associated with this condition of otosclerosis. The list of associated defects which they have found was obtained by examining exhaustively 25 patients with otosclerosis and later a total of 70. Thus among the defects that they found were anomalies in the vasomotor group, including dermographism and acrocyanosis. There was a case of respiratory irregularities, one of bulbous pressure reflex, etc. Similarly they found anomalies in the sex sphere, including menstrual irregularities in the female and hypoplastic genitalia in the male. They found one or more abnormalities in hairiness of the body, high palate, migraine, and dental caries with early loss of teeth and abnormalities in the position of the teeth. They emphasized these findings in their earlier paper but were inclined to lay less stress on them in their later contribution. They called attention in their later paper to the fact that of 35 otosclerotic persons observed, 7 were exceptionally large, 7 exceptionally small, 4 decidedly obese, 8 very slender and 4 blue-eyed.

It seems remarkable that men of the scientific standing of Bauer and Stein should set forth these data seriously. It can hardly be doubted that any middle-aged person, carefully examined, will show some sort of a somatic defect, and if the persons happen to be otosclerotic they may still be expected to show some somatic defect besides otosclerosis. Of course, it does not follow that the somatic defect found in the latter case will, in any way, necessarily be associated with the otosclerosis. In any case the significance of the results given depends entirely on their comparison with a similarly selected lot of controls. Thus that 35 otosclerotic persons had blue eyes is not sig-

nificant unless it can be shown that a similar group of nonotosclerotic persons in the same population would have a smaller incidence of blue eyes. Also the mere existence of a difference in proportions between a group having one defect and the control group is not significant. Thus when Leicher found that 75 per cent of the otosclerotic persons investigated by him had a diminished calcium content of the blood, that means very little—perhaps nothing. Fifty per cent of the population are expected to have a calcium content less than the average of the population, just as 50 per cent have a higher calcium value. Seventy-five per cent is, therefore, only 25 per cent above expectation. Also, a reduced calcium value means nothing unless the degree of the diminution in relation to the probable deviation based on the normal probability is set forth. It is not strange, therefore, that other investigators have not been able to confirm Leicher's figure of 75 per cent, but some of them have found around 50 per cent, which means nothing exceptional. Indeed Bauer and Stein's earlier paper indicated chiefly a widespread defect among medical investigators in stressing individual cases and the fact of average deviations, instead of comparing the selected lot with a control and without giving the probable error of the variable series. Bauer and Stein [52] indeed stated that today we must conclude: "dass eine regelmässige Bindung der Otosklerose an bestimmte andere Konstitutionsanomalien, sei es der äusseren Körperform oder bestimmter innerer Organe, nicht nachzuweisen ist [that a regular linkage of otosclerosis with certain other constitutional anomalies, whether of the external contour of the body or of certain internal organs, is not demonstrable]." In regard to the significance of the initial occurrence of these various defects Bauer and Stein are also not insistent. Indeed they said [53] that it is difficult to judge properly the value of their findings so long as they are not thoroughly informed concerning the frequency of the different stigmas and concerning their mutual correlations in the population at large. Nevertheless, they hazard a conclusion that the greater frequency of the most varied indications of degenerative constitution in one and the same individual with otosclerosis and their proper classification as status degenerativus is sure. On the other hand, to our way of thinking, there is no evidence that otosclerotic persons belong to a general class of degenerative status until it is shown that they have, besides otosclerosis, one or more definite defects which occur in markedly greater excess than in the population to which they belong as a whole.

On the other hand, the evidence is good that otosclerosis is only one manifestation of a tendency toward mesoblastic defect; mesoblastic defect may take other forms in otosclerotic persons. Among these

52. Bauer and Stein (footnote 34, p. 522).

53. Bauer and Stein (footnote 34, p. 523).

defects are new formations in the temporal bone, already referred to, fragilitas ossium and the blue sclerotics that often are associated with such fragility. Such defects are not merely defects in calcium metabolism. They are profound defects in osteogenesis. In the case of the bony trabeculae of the long bones, in place of the normal apposition of bone by osteoblasts on a preexisting cartilaginous matrix, the new trabeculae are formed by the direct metaplasia of persisting cartilaginous cells into bone cells. Also, in place of the normal cortical bone with its haversian systems of concentric cylinders, there is formed a bone without haversian systems. Since the latter are the most efficient agents for knitting the bone together, their absence is the explanation of the weakness of these long bones. For this abnormal bone formation the conclusion of Schwartz and Bass [54] seems warranted: Heredity is the only important etiologic factor.

It may or may not be significant for the relation between otosclerosis and osteopsathyrosis that the latter trait is inherited as a simple dominant (Conard and Davenport [55]). It is plausible that the autosomal gene, A, of otosclerosis may be equivalent to the gene for osteopsathyrosis, with a modifying factor which locates the osteogenic defect in the long bones rather than in the cartilaginous bones of the skull.

3. *Relation of Otosclerosis to Other Diseases of the Ear.*—Earlier in this paper references have been made to the conclusion of Bauer and Stein [34] that otosclerosis, labyrinthine hardness of hearing and deaf-mutism have a hereditary, biologic relationship. This conclusion is based on the fact that the family history of an otosclerotic person is apt to show not only other otosclerotic persons but also those with progressive hardness of hearing and deaf-mutism.

In our experience with over 100 pedigrees involving several thousand persons we have found only 3 deaf-mutes. We are doubtful if this is a higher frequency than would be found in the general population. It would not be surprising, however, if an excess of deaf-mutism were found in families of otosclerotic persons because of the well known process of mate selection among the deaf which results from the fact that the deaf are thrown together.

Our pedigrees, it is true, show many cases of progressive hardness of hearing beginning late in life that probably fall into the category of progressive labyrinthine hardness of hearing. It must be admitted, however, that with the inability to make laboratory diagnoses in the field and on account of the necessity of depending on hearsay

54. Schwartz, H., and Bass, M.: Osteogenesis Imperfecta, M. Rec. **82**:317, 1917.

55. Conard, H. S., and Davenport, C. B.: Hereditary Fragility of Bone (Fragilitas Osseus, Osteopsathyrosis), Bull. 14, Cold Spring Harbor, Long Island, N. Y., Eugenics Record Office, 1915.

evidence regarding persons who have long been dead, the precise classification of hardness of hearing in different members of the family is very uncertain. The loss of the lower tones has been much relied on for diagnostic purposes, yet Shambaugh has found cases of otosclerosis in which the higher notes are lost more completely than the lower ones. Indeed otologists have reached the conclusion that in otosclerosis the acoustic nerve may become eventually affected or in some cases the acoustic nerve may become affected before evidences of fixation of the stapes appear. In our present lack of detailed knowledge concerning all the changes in the bony capsule of the ear and their possible effect on the end-organs in the vestibule and cochlea, it is not strange that a confusion between these 2 types of deafness appears. In fact, it may well be that one runs over into the other. However, as long as progressive labyrinthine hardness of hearing is not shown to be associated with badly formed bony elements of the petrosa, a theoretical separation of the 2 classes of hardness of hearing is possible.

Practically, the distinction based on the age of onset of hardness of hearing would seem to be the best popular difference, since testing with the tuning fork is not possible in those who are no longer living or who are otherwise inaccessible. The work of Bauer and Stein indicates, indeed, the inheritance of labyrinthine deafness, but as long as there are an excess of males affected by labyrinthine deafness and a marked excess of females affected by otosclerosis, it can hardly be maintained that the 2 defects will depend on the same genes.

4. *Relation of Otosclerosis to External Conditions.*—Modern genetics looks on genes as the internal directors of development. Rarely does each gene work independently of other genes that are engaged primarily in directing the development of other organs. Always the course of development of the individual and the directing influence of its different genes are modifiable by change of the environment. It is obvious that otosclerosis is no exception to this rule.

The data that we have given in our family histories indicate some of the influences of external conditions. Foremost is, in the female, pregnancy. This tends frequently to exaggerate the symptoms, sometimes permanently, sometimes temporarily, with even an improvement in hearing between pregnancies. In some cases, however, it is stated that pregnancy did not affect the symptoms.

The next commonest associated condition is nasal "catarrh." Indeed otosclerosis formerly, in many places, bore the name "dry catarrh." While it is easily understandable that infection of the nasal passages, including the eustachian tube, may lead to otitis media, it is not so easy to see why it so often accompanies otosclerosis. Possibly the tendency toward imperfect bone formation of the otic capsule extends also to the nasal conchae and ethmoid, causing partial obstruction of the passage

and favoring infection. Frequently otosclerotic patients undergo nasal operations with relief from "catarrh" but not from defects in hearing.

Other external conditions that are believed to have "brought on" otosclerosis, or to exaggerate its symptoms are: colds, scarlet fever, influenza, a high dry location and the use of quinine. These can hardly be regarded as sufficient causes for otosclerosis but merely as external conditions modifying its progress.

B. SUMMARY OF CONCLUSIONS

By a rough estimate, about 0.2 per cent of the white population of the United States is otosclerotic. In certain fraternities 100 per cent are otosclerotic. The hereditary factor is thus obvious.

The petrous portion of the temporal bone, which contains the otic capsule, has a particularly complicated embryologic history, so that any disturbances or imbalance of the osteogenic function would be especially apt to affect the otic capsule.

The beginnings of deafness were first noticed in otosclerotic persons at from 4 to 55 years. Persons in the older age group are commonly, but not always with justification, suspected of progressive labyrinthine disease.

The original data of this paper were obtained, in part, by house-to-house visits of trained eugenic field workers, who gave auditory tests, and in part by correspondence.

Sixty new families were studied and the distribution of otosclerosis in them was analyzed to get at the law of inheritance.

Approximately twice as many females as males are affected with otosclerosis, but other types of hardness of hearing affect the sexes equally.

In body build otosclerotic persons do not differ significantly from their nonotosclerotic siblings of the same sex, except that in pelvic breadth, in relation to shoulder breadth, and in chest girth the otosclerotic females seem to be more slender than their sisters.

When both parents are otosclerotic, nearly all their daughters are otosclerotic or have a hardness of hearing of some type (one exception in a case from the literature). About two thirds of the sons are otosclerotic.

When the mother only is affected, the proportion of affected sons and daughters is about the same.

When the father only is affected, the daughters are affected about 50 per cent more frequently than the sons.

When neither parent is affected and some of the children are affected, the 2 sexes are equally affected.

Ten hypotheses are tried out on the basis of these data, and the one that meets with no serious difficulty is: Otosclerosis develops under

external conditions that favor it whenever the patient has a constitution that combines 2 dominant factors as follows: a factor X which lies in the sex chromosome and also a factor A, which lies in 1 of the autosomes.

On the foregoing hypothesis the female zygote has the same half chance as the male of getting an X-chromosome from the egg; the other half has received an affected X-chromosome from the sperm. Hence, we should expect twice as many zygotes carrying an affected X-chromosome in the females as the males—and this agrees closely with observation.

The hypothesis is suggested that the autosomal gene modifies the reaction of the mesenchyme and especially the osteoclasts and osteoblasts. The sex-linked gene acts differentially between the sexes, possibly affecting calcium metabolism.

The evidence that otosclerotic persons belong to a degenerative class (Bauer and Stein) seems inadequate. But defects in the mesenchyme occasionally occur elsewhere than in the otic capsule, leading to exostoses, to brittle bones and to blue sclerotics.

The evidence that otosclerosis, labyrinthine hardness of hearing and deaf-mutism have the same genetic basis is hardly adequate; still, overlapping of these conditions may occur.

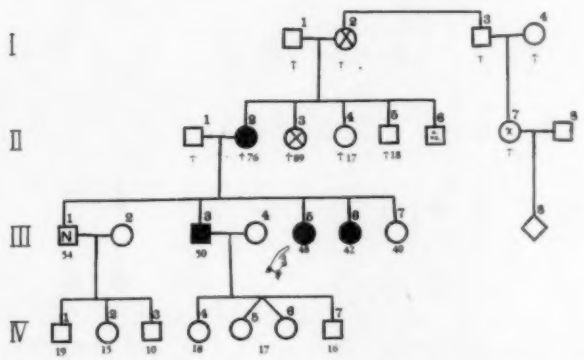


Fig. 1.—A United States family of British stock (referred from the Volta Bureau; data obtained by correspondence). *I 2* died at 44 years of tuberculosis. She used a small horn to hear conversation. *IV 1-7*, children below the age of onset of deafness. In this and the accompanying figures, the circles indicate females; the squares, males. Solid black symbols indicate that the individual thus represented is regarded as otosclerotic. A cross through the symbol means "hard of hearing;" either the condition is probably not otosclerosis or the evidence as to the nature of the defect is inadequate for a diagnosis.

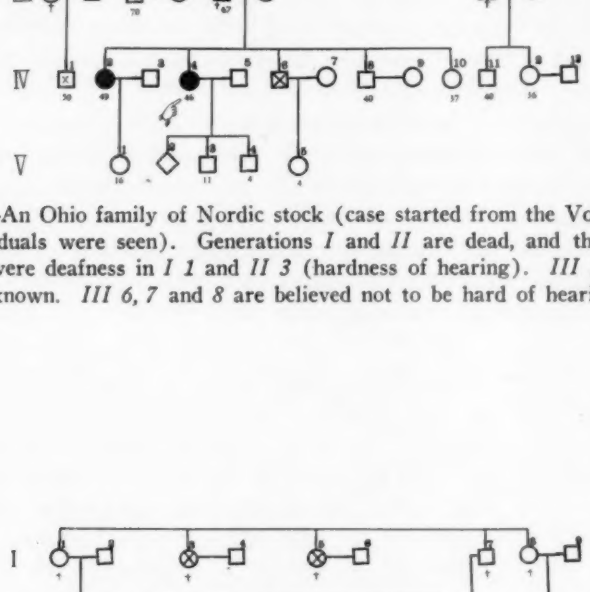


Fig. 2.—An Ohio family of Nordic stock (case started from the Volta Bureau; some individuals were seen). Generations *I* and *II* are dead, and there is testimony of severe deafness in *I 1* and *II 3* (hardness of hearing). *III 1* and *2* are dead or unknown. *III 6, 7* and *8* are believed not to be hard of hearing.

Fig. 3.—A western family of Nordic stock (data obtained by the Volta Bureau by correspondence). *I 3* was deaf at 50 years. *I 5* was deaf in middle life. *II 11* became deaf early in life.

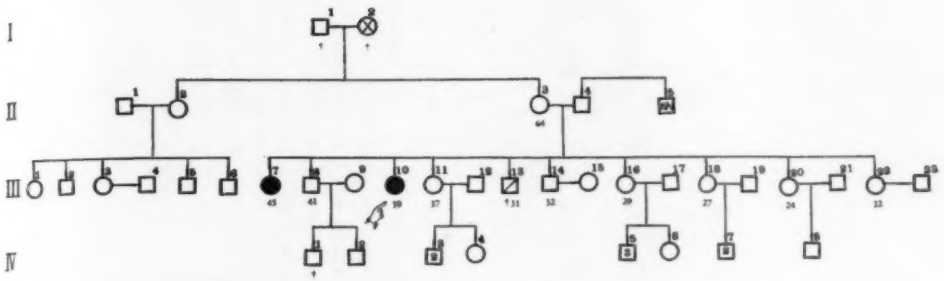


Fig. 4.—A United States family from New York (members seen by Dr. Duel).

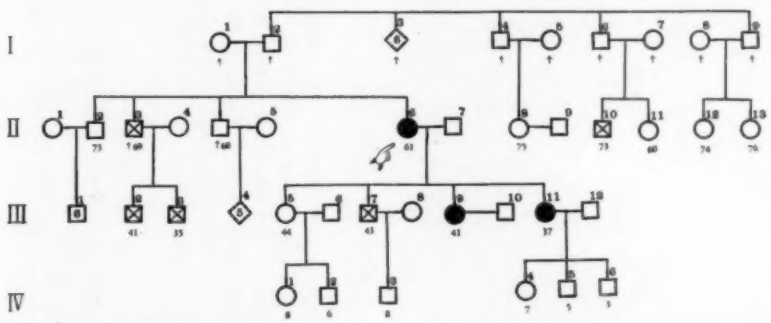


Fig. 5.—A family of Nordic stock (referred from the Volta Bureau; data obtained by correspondence). *II 3* is said to have been hard of hearing. *II 10* is said to be hard of hearing. *III 2* and *3* are said to be hard of hearing.

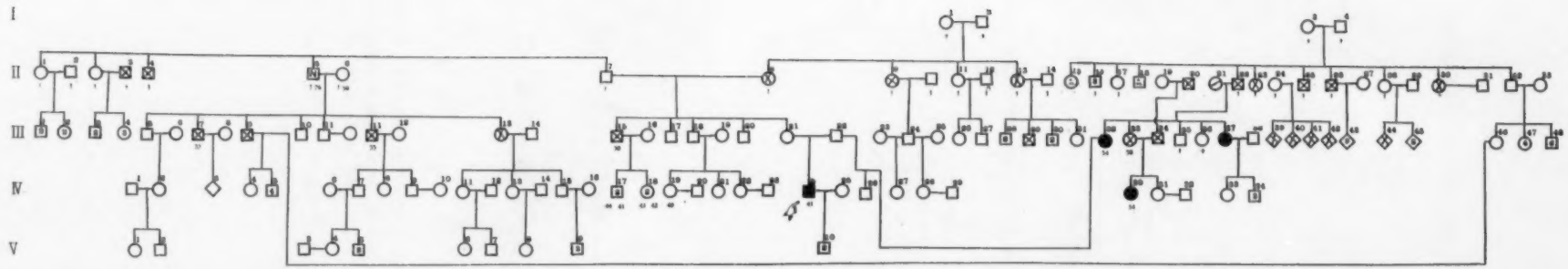


Fig. 6.—A United States family, chiefly of Nordic stock (case started from the Volta Bureau; some individuals seen). *II 3* and *4* are thought to have had a defect in hearing. *II 20* was hard of hearing. *II 21* became hard of hearing with old age; it is doubtful if this was otosclerosis. *II 22* had a deafness in the left ear, first noticed at the age of 28 on his return from the Civil War. This was accompanied by a ringing tinnitus. *II 23* was totally deaf. *II 25* is said to have been hard of hearing. *II 26* was ascertained to be hard of hearing, but not totally deaf. *II 30* is stated to be hard of hearing. *III 7* has a slight deafness which has come on in the past few years. There are no noises in the head; infection of the sinuses is reported. The loss of hearing is not readily noticeable and it is doubtful if the condition is otosclerosis. This patient was seen by Miss Frink. *III 9* is hard of hearing. *III 11* is becoming deaf. *III 13* is very deaf. *III 15* and *III 29* are said to be hard of hearing. *III 32* has had gradual loss of hearing since 40 years of age, the first difficulty having been noticed at 18. The defect is worse in the left ear and is ascribed to tonsils and adenoids. *III 39* to *42* are all deaf, 1 being very deaf. *III 44* is also very deaf.

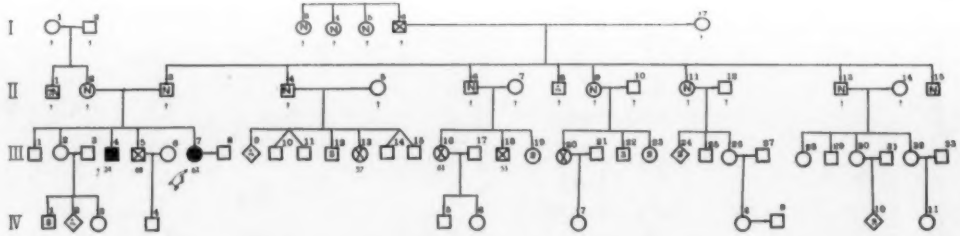


Fig. 7.—A family of British stock, living in the central part of the country. *I 6,* now dead, is said to have been deaf, while his 3 sisters had normal hearing. There is no deafness in the second generation. *III 13, 16* and *18* are said to be deaf; they were not seen, and no details are available. *III 20* became deaf shortly after the death of her husband.

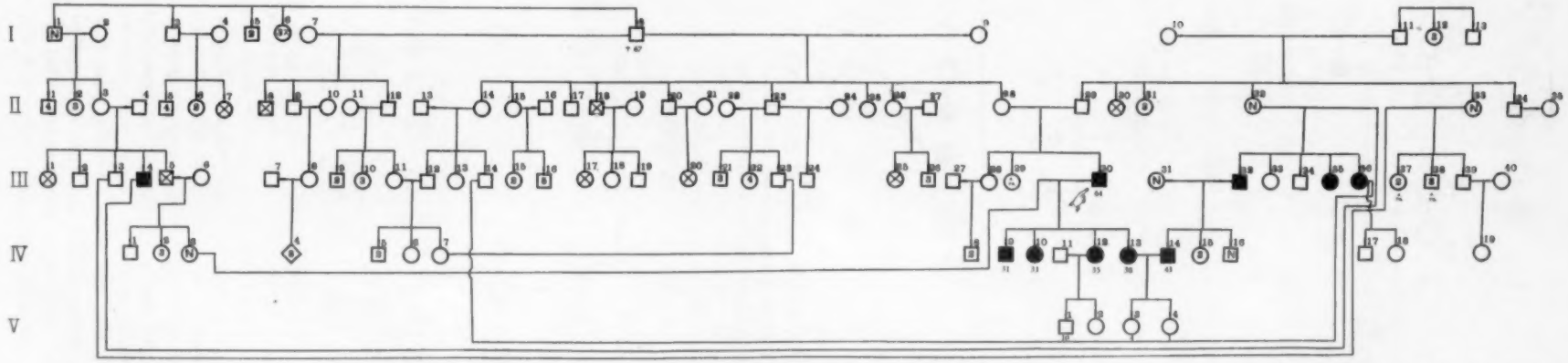


Fig. 8.—A family of Scotch and English stock, living in the eastern part of the United States and New Mexico (introduced by the Volta Bureau; data obtained by correspondence and personal investigation by Dr. Milles).

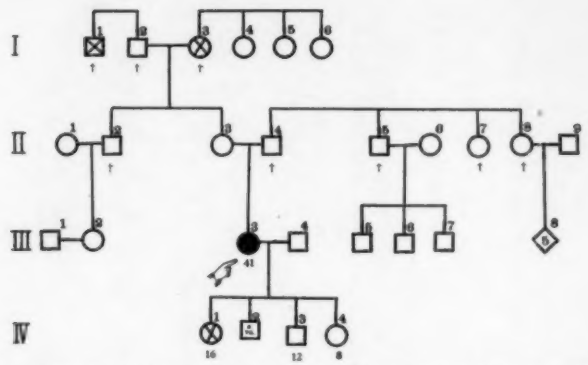


Fig. 9.—A United States family of professional people living in Arkansas and Greater New York.

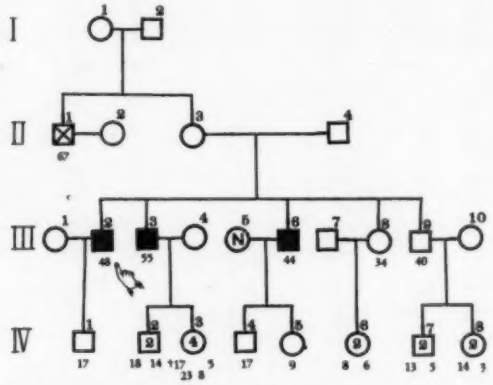


Fig. 10.—A family of prevailingly Nordic stock living in the central part of the United States and on the Pacific Coast (case referred from the Volta Bureau; data obtained through correspondence).

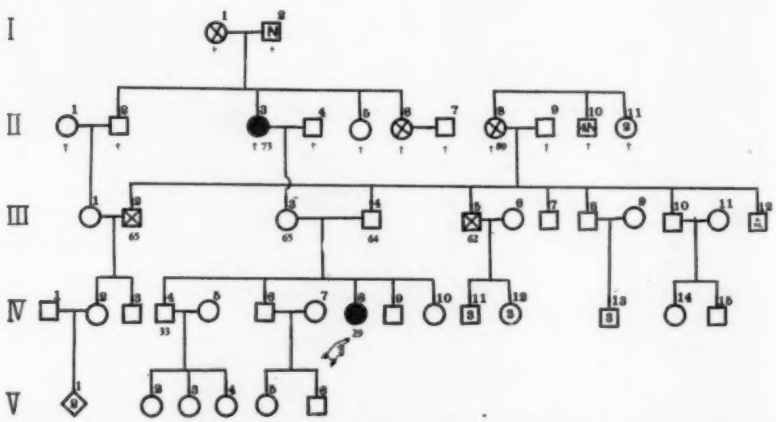


Fig. 11.—A family of British stock, mostly living in the eastern part of the United States. *I 1* is known to have been deaf. *II 3* had a deafness that came on suddenly and became slowly worse, but was not total at death. It was accompanied by frontal headaches, a slight tinnitus and severe colds. Tonsillectomy was performed and all the patient's teeth were lost in the early twenties. The condition was reported by *III 2* as otosclerosis. *II 6* is said to have been deaf. *II 8* became deaf at 18 years. Deafness has progressed more rapidly in the right ear. Tinnitus is present. False teeth were acquired in the early thirties. *III 2* is an ear, nose and throat specialist who first noticed his defect of hearing in the left ear during middle age; it is accompanied by severe tinnitus. The teeth are excellent. *III 5* has a progressive deafness which is most pronounced in the right ear. He can hear conversation when it is distinct.

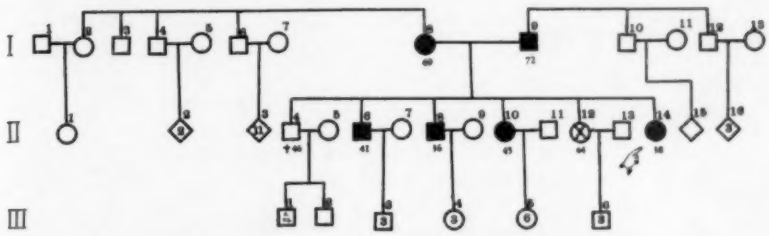


Fig. 12.—A family of Nordic stock, living in the central part of the country (referred from the Volta Bureau; data obtained through correspondence).

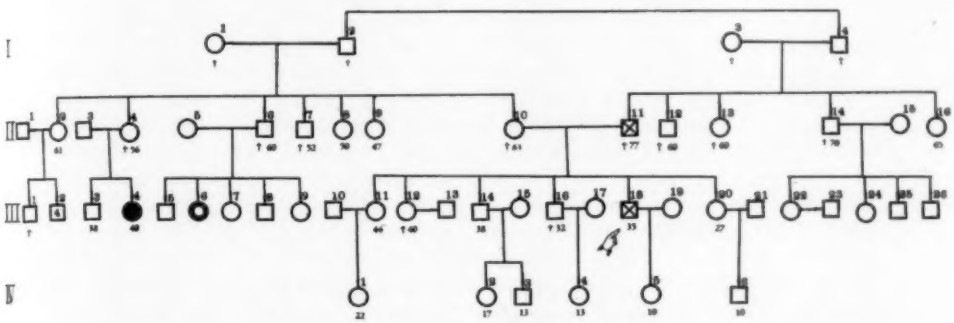


Fig. 13.—A family of Nordic stock. *II 11* had hardness of hearing which began in later middle life and was accompanied by a slight roaring. His teeth were resistant. (The condition is probably labyrinthine deafness or presbycusis). *III 6* was a deaf-mute. *III 18* has a deafness, especially in the left ear, which was first noticed at 18 or 20 years of age; it began without obvious cause, and was accompanied by headaches, severe tinnitus, and in the beginning, dizzy spells. He had infected sinuses and many colds, and later, sore throat. His teeth decay fairly easily. He is now practically deaf. The condition has been diagnosed as "nerve deafness."

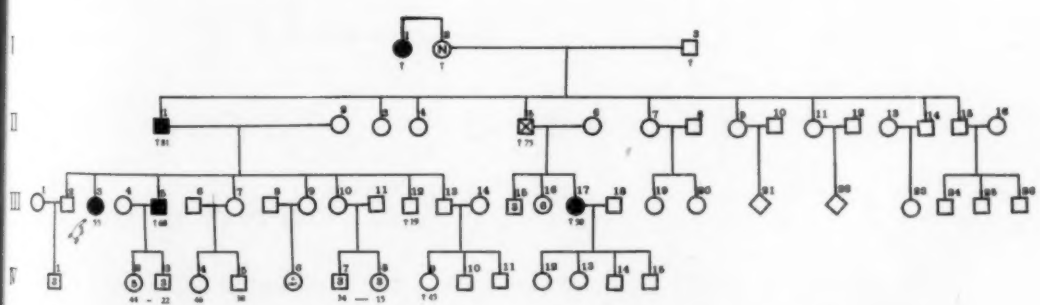


Fig. 14.—A family of Nordic stock, living largely in the Mississippi valley (referred from the Volta Bureau; data obtained by correspondence).

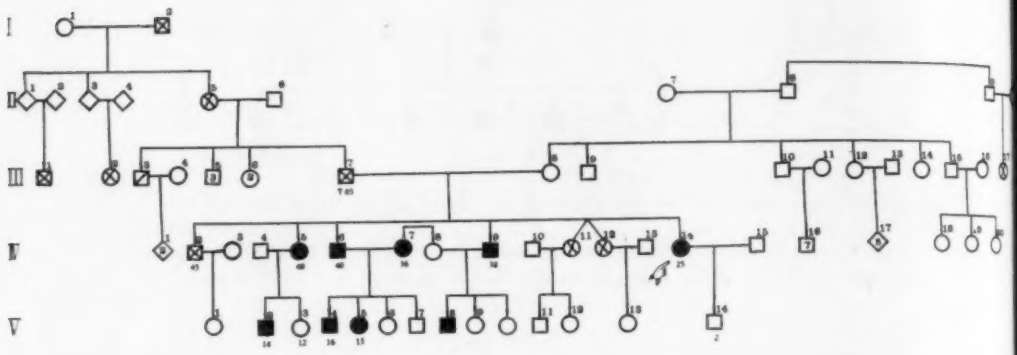


Fig. 15.—A family of Polish-Jewish stock. In *I 2* there is a tradition of deafness. *II 5* is said to have been deaf, as are *III 1, 2, 7* and *17*. *IV 2* is said to be hard of hearing. *IV 5* has a progressive hardness of hearing that was first noticed in her right ear at 27 years of age and in her left ear at 29. It is not severe in the right ear. The onset occurred after the birth of her first child. She has tinnitus but no headaches and only slight dizziness. The sinuses and nose are resistant. The patient has few colds but suffered from sore throat before her marriage. False teeth were acquired at the age of 28. Though there is a loss of hearing, especially for the high tones, this case is regarded by Dr. Harris as probably otosclerotic. *IV 9* has a hardness of hearing which has progressed to his present age of 38. *IV 11* and *12*, twin sisters, have progressive hardness of hearing. *IV 14* also has a progressive hardness of hearing, which first became pronounced after the birth of a child. She has frontal headaches, severe and frequent attacks of vertigo, tinnitus and painful menstruation, with headaches. Lactation lasted for eight months with her only child. The sinuses are normal. The throat is frequently sore, but colds are rare. The teeth are in good condition. *V 2*, 14 years old, shows loss of hearing, especially for high tones. *V 8* shows beginning loss of hearing.

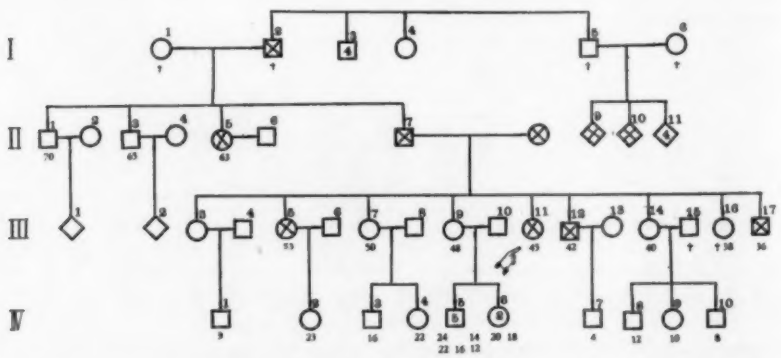


Fig. 16.—A family chiefly of British stock, living in the central and western part of the United States (referred from the Volta Bureau; details obtained by correspondence only). *I 2* is said to have been deaf at the age of 45. *II 5* is said to have been deaf. *II 9* and *10* became deaf after they were grown up.

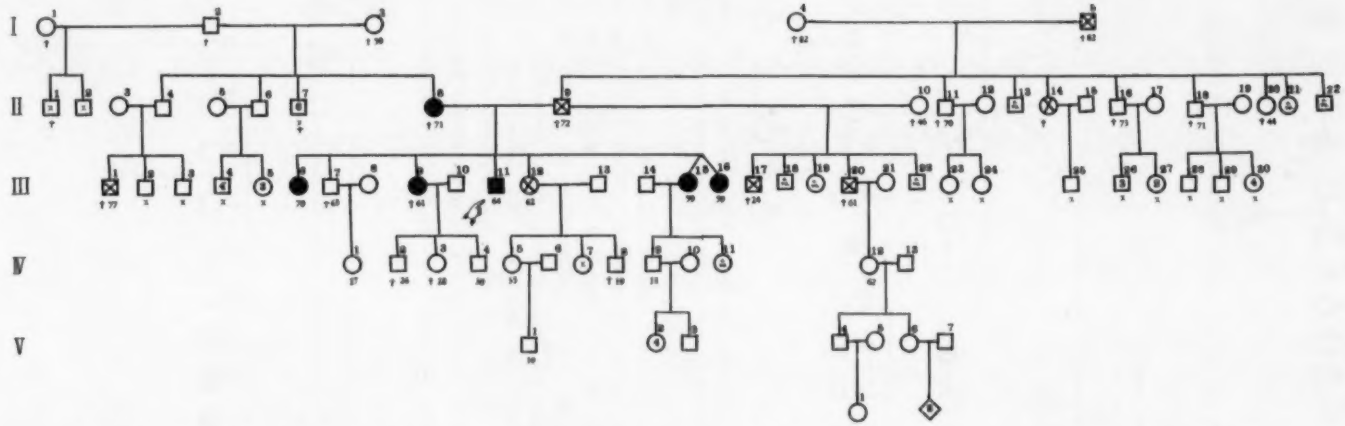


Fig 17.—A family mostly of English stock, living in Canada and the western part of the United States (referred from the Volta Bureau; data obtained by correspondence). *I 5* is deaf at the age of 82. *II 14* was deaf at the time of death, at 70 years. *III 1*, who died at the age of 77, was deaf in his old age. *III 17* had a hardness of hearing first noticed at 16 years of age and ascribed to fever. He died at 24 years of age. *III 20* had a hardness of hearing which was first noticed at about the age of 25, and which was ascribed to cannon fire. He never wore false teeth.

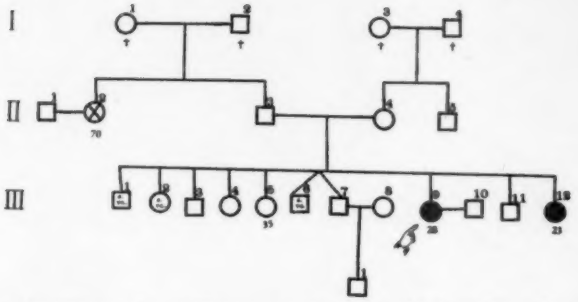


Fig. 18.—A family mostly of German stock (data obtained from Dr. Harris).

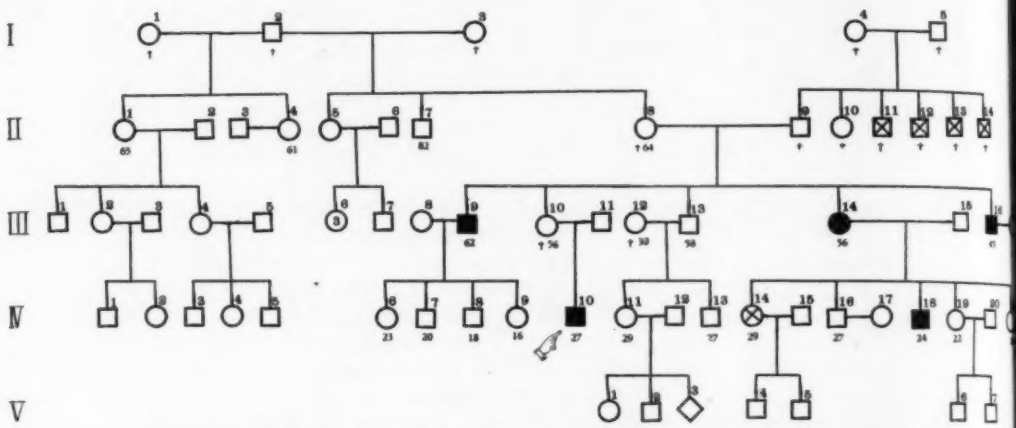


Fig. 19.—A family mostly of Nordic stock, living in Virginia and Ohio (introduced by the Volta Bureau; personally investigated by Dr. Milles). *IV 10* has a hearing which shows about a 50 per cent loss. The defect was first noticed at 12 years of age and was ascribed to catarrh or measles. He has roaring noises in the head and frequent headaches but no dizzy spells; he is subject to colds and infection of the sinuses. *IV 14* has a defect in hearing first noticed at the age of 23, especially in the right ear; it is due possibly to rupture of the ear drum caused by childbirth. No loss of hearing occurred in connection with the second pregnancy. The patient has few headaches, no dizzy spells and no tinnitus. She has sound teeth. *IV 18* has a progressive deafness, first noticed at about 18 years of age; it is worse in the right ear. The cause has not been determined. He has no headaches, dizzy spells or tinnitus and only occasional colds. The teeth decay easily.

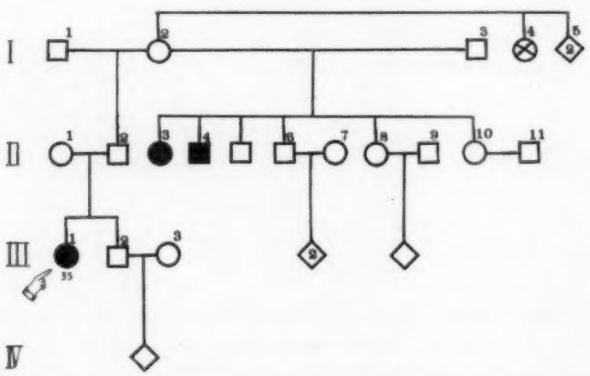


Fig. 20.—A family of English stock, living in England and California (referred from the Volta Bureau; information obtained by correspondence). *I 4* is said to have been hard of hearing. *II 3* has a hearing defect which has progressed rapidly until, at the age of 32, she is very deaf. *II 4* has a difficulty in hearing which was first noticed at the age of 14 years and has since progressed rapidly.

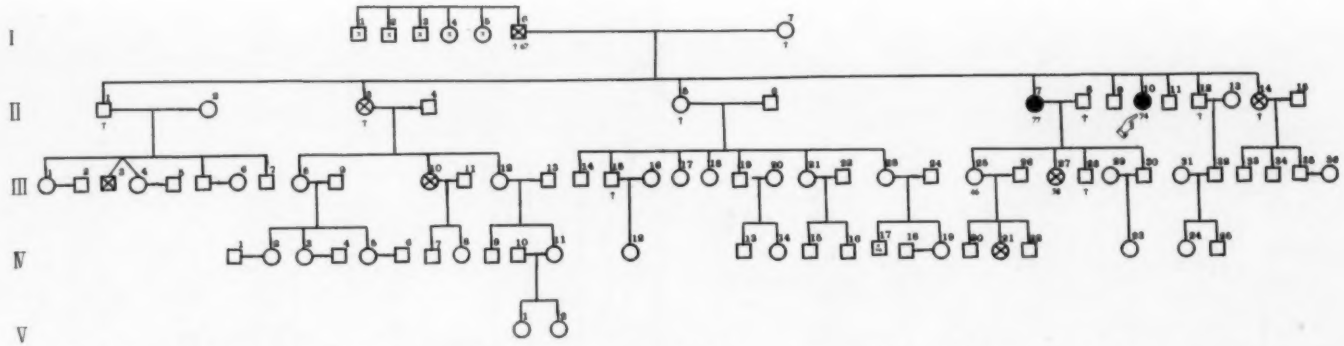


Fig. 21.—A German family, living mostly in New York and Chicago (data obtained from Dr. Harris; family history secured by Dr. Milles). *I 6*, who died in Germany, and *II 3* were deaf. *III 3* and *10* are deaf.

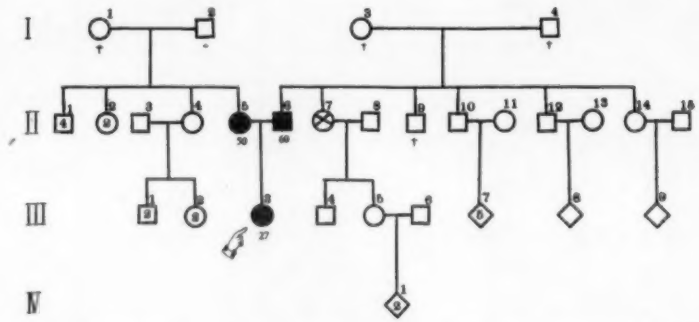


Fig. 22.—A family of English stock, from Virginia (referred by Dr. Duel).

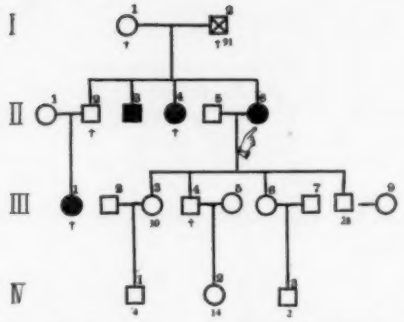


Fig. 23.—A pedigree obtained through the Volta Bureau by correspondence. *I 2* had deafness, primarily in 1 ear. It is said to have been caused during middle life by an abscess. *II 3* had a progressive deafness which began at about the age of 30. *II 4* had a hearing defect, beginning at 16 years of age and increasing markedly after typhoid at 25. *II 6* had a deafness that began at the age of 18.

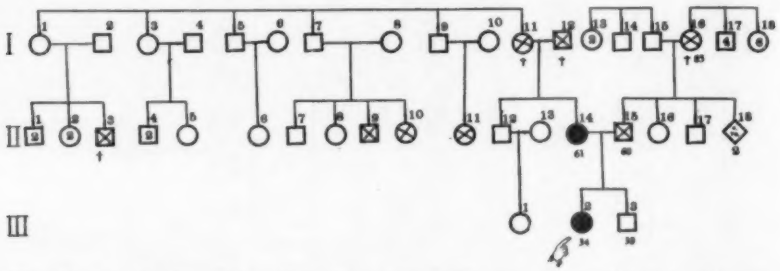


Fig. 24.—A family of English, French and German stock living in the central part of the country (referred by Dr. Shambaugh). *I 11* and *12* were a trifle deaf in old age. *I 16* said to have been hard of hearing; further details are unknown. *II 3* was slightly deaf during old age. *II 9* and *10* became deaf in their early thirties.

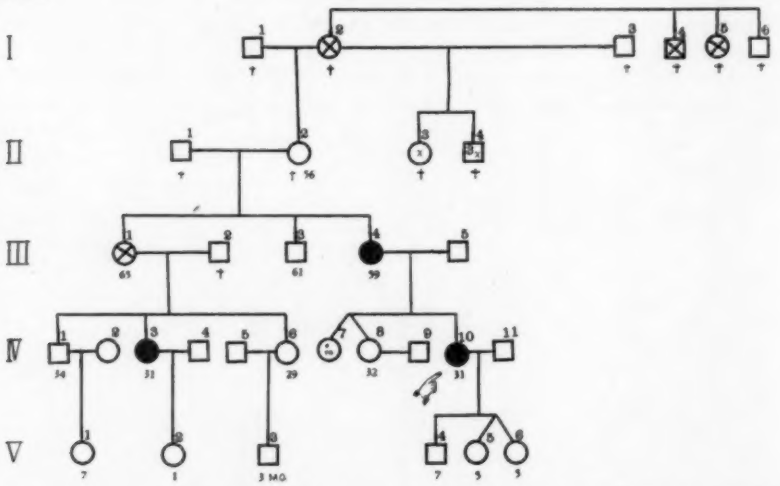


Fig. 25.—A family of British and German stock living in eastern Pennsylvania. *I 2* was practically stone deaf at the age of 35. *I 4* and *5* are said to have been deaf. *II 1* is said to have deaf cousins; no particulars are available. *IV 3* has hardness of hearing in both ears; this was first noticed at the age of 31, after the birth of a child. She has had a tonsillectomy.

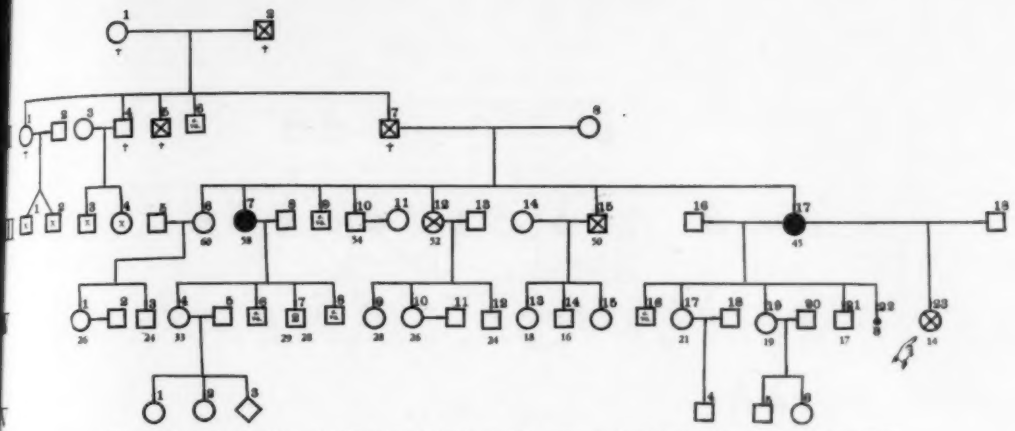


Fig. 26.—A family of Nordic, chiefly Irish, stock (referred from the Brooklyn Ear and Eye Hospital; seen by Dr. Milles). *I 2* is known to have been deaf.

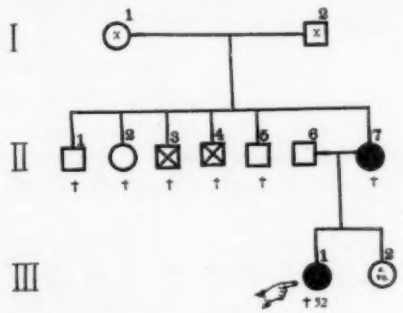


Fig. 27.—A family of Scandinavian stock (referred by the Volta Bureau; data obtained by correspondence).

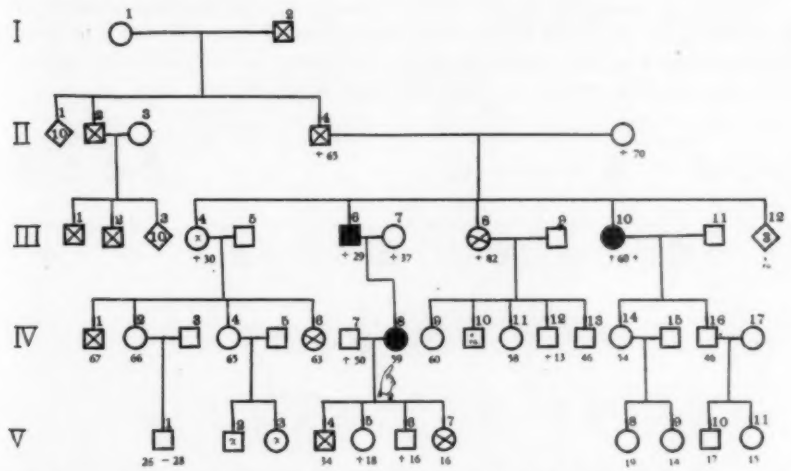


Fig. 28.—A family of prevailingly British stock, living in the eastern part of the United States. *I 2* is said to have been hard of hearing, probably from an early age. *II 2* is deaf. *II 4* is said to have been deaf from youth. *III 1* and *2* are said to be hard of hearing. *III 8* had slightly impaired hearing during his old age. *III 10* had a progressive hardness of hearing which began between 23 and 26 years of age and became marked. *IV 6*, who is in his twenties, has a hardness of hearing that has progressed far. *V 4* has a progressive hardness of hearing which was first noticed on his return from the World War in his twenties. No discharge from the ears or earache is reported. *V 7* has infected tonsils. The infection has spread and affected the left ear. A slight tinnitus is present.

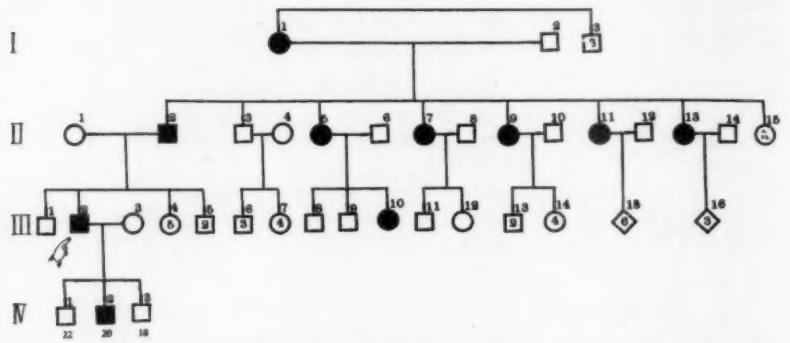


Fig. 29.—A family mostly of English stock (referred from the Volta Bureau). In *II 7* hardness of hearing developed, which became severe in early adult life. *II 9* was deaf by middle life. In *II 11* and *13* deafness developed in middle life. In *IV 2* deafness developed in his early twenties.

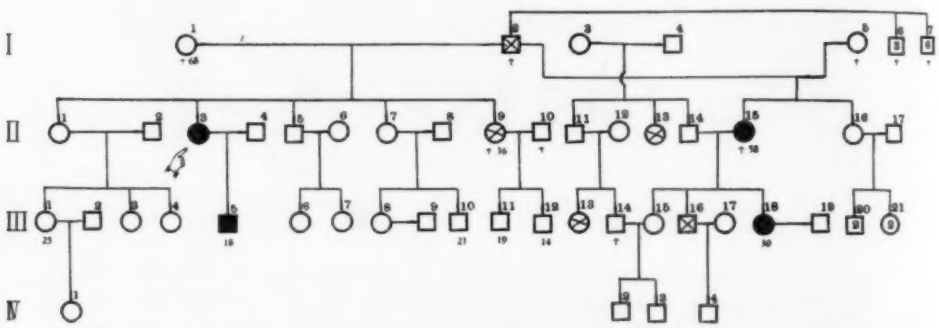


Fig. 30.—A family of Jewish stock in Greater New York (data obtained from Dr. Harris). *I 2* was deaf at his death at an advanced age. *II 3* has a progressive deafness which was first noticed at 13 years of age. *II 9* first noticed deafness at 24 years. *III 13* is said to be deaf. *III 16* is said to be deaf.

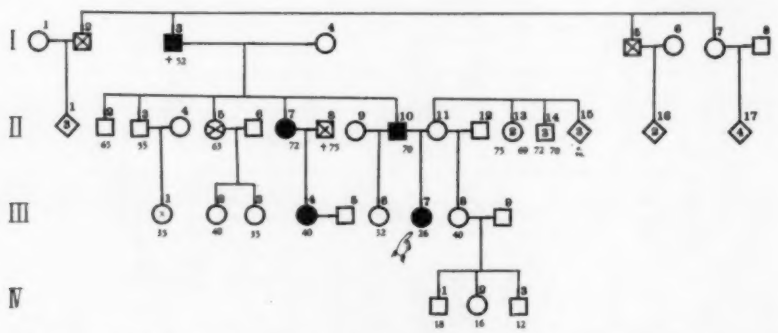


Fig. 31.—A family of prevailingly British stock (referred from the Volta Bureau; data obtained chiefly through correspondence). *I 2* is believed to have been deaf. *I 3* had a hardness of hearing which began at 30 years with symptoms like those of *II 10*. *I 5* is stated to have been somewhat deaf. *III 7* has a gradually progressing hardness of hearing that began at about 14 years of age and now involves a loss of about 50 per cent. She has paracusis and a little sinus trouble, is subject to headaches, has a pronounced tinnitus, is very susceptible to colds and has nonresistant teeth.

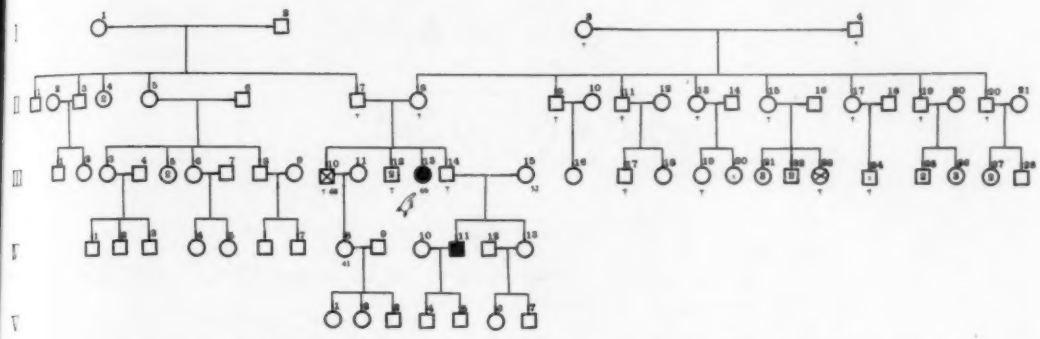


Fig. 32.—This pedigree was referred from the Volta Bureau. The propositus was seen by Dr. Milles.

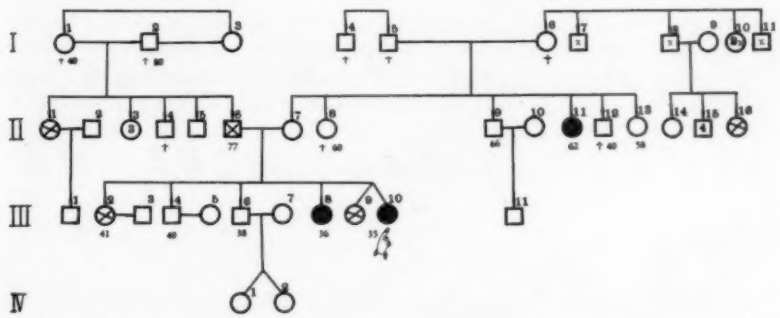


Fig. 33.—A family of German stock (data secured through Dr. Shambaugh; several members of the family seen personally by Dr. Milles and Miss Frink). *II 16,* who is in Germany, is said to be deaf. *III 2, 8, 9* and *10* were examined by Dr. Shambaugh.

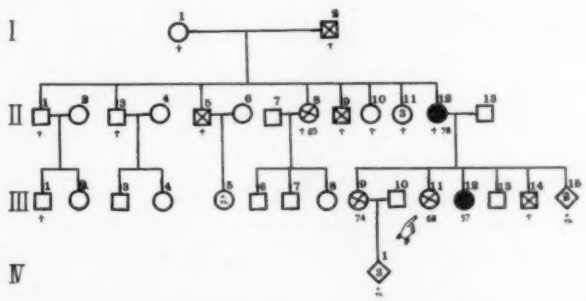


Fig. 34.—A family of Scotch and English stock, living mostly in Chicago and other parts of the Mississippi Valley (referred by Dr. Shambaugh). *I 2* is known to have been deaf. *II 5, 8* and *9* are stated to have been hard of hearing; no details are available.

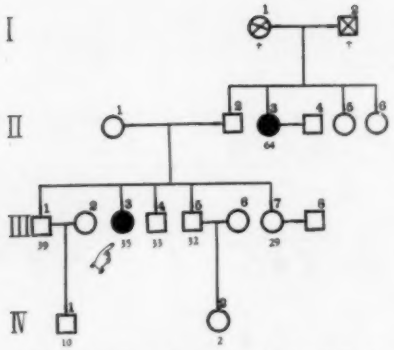


Fig. 35.—A family chiefly of Scotch stock, in the Mississippi Valley (referred from the Volta Bureau; data obtained by correspondence).

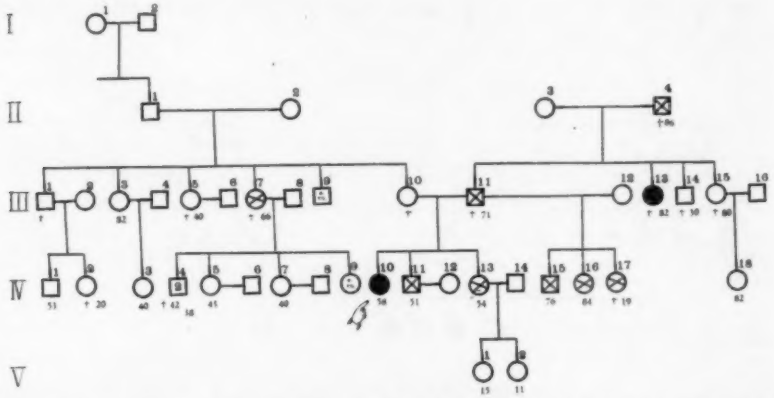


Fig. 36.—A family of prevailingly English stock (referred by the Volta Bureau; data obtained through correspondence). *II 1* had a deaf aunt (it is not stated whether she was on the maternal or the paternal side). *III 7* is said to have been noticeably deaf. *III 13* had a progressive deafness which started when she was a young woman and which was ascribed, in part, to catarrh. She could hear a loud voice, and never used an instrument. *IV 15* stated that he has been hard of hearing in 1 ear for a good many years. The hearing of *IV 16* was never acute, and is now considerably impaired. *IV 17* was deaf at death, the condition beginning in early childhood.

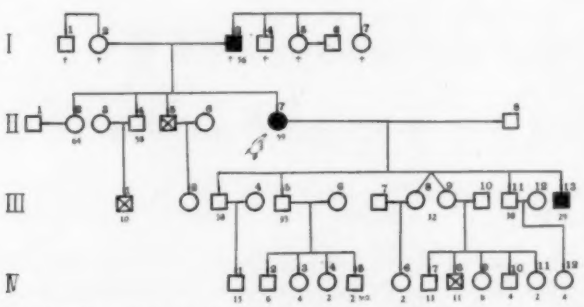


Fig. 37.—A family of prevailingly English stock (referred from the Volta Bureau; data obtained by correspondence). *IV 8*, 11 years of age, is slightly hard of hearing.

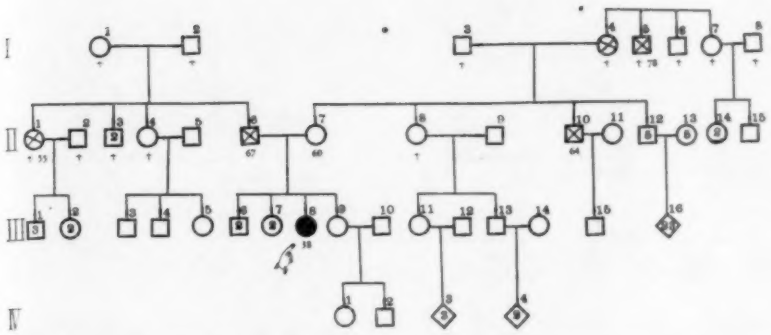


Fig. 38.—A family of British stock (referred from the Volta Bureau; data obtained by correspondence). *I 4*, who died at 70 years of age, was hard of hearing. *I 5* died at the age of 78; he had been hard of hearing from at least the age of 50. *II 1* is stated to have had hardness of hearing, beginning at the age of 24, during her first pregnancy.

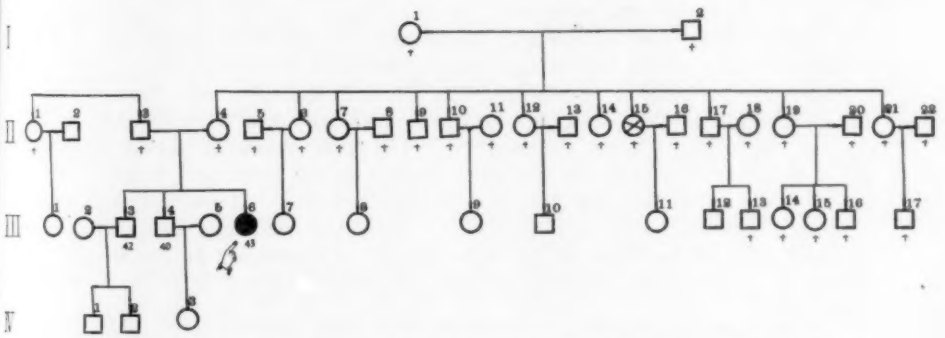


Fig. 39.—A family chiefly of British stock (referred from the Volta Bureau; data obtained by correspondence). *II 15*, who died of cancer of the breast, had a progressive deafness which was first noticed at about 21 years of age.

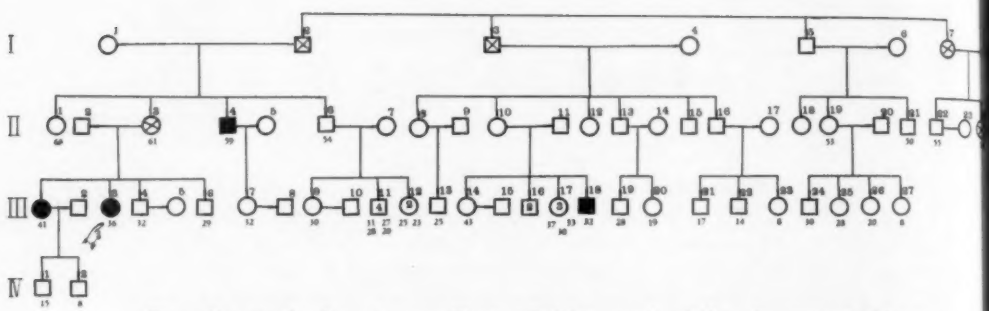


Fig. 40.—A family of prevailingly British stock, living in central Massachusetts (pedigree referred by Dr. Duel). *I 2, 3* and *7* are stated to have been deaf. *II 3* has a progressive deafness which is worse in the right ear; it was first noticed at 55 years of age, and is accompanied by an irregularly occurring headache but no dizzy spells or tinnitus. The teeth decay easily. It is doubtful if this patient has otosclerosis. *II 4* has a progressive hardness of hearing which is equally severe in the 2 ears; it was first noticed between 25 and 30 years of age, and is accompanied by few headaches and no dizzy spells. Tinnitus is occasionally present. *II 24* has a progressive hardness of hearing in the left ear only; it was first noticed at 25 years of age and was ascribed to catarrh. She has had the turbinate bones removed, and the tonsils were clipped at the age of 24. *III 1* has a progressive hardness of hearing which is worse in the right ear; it was first noticed at the age of 38. She has headaches irregularly and no dizzy spells or tinnitus. With the right ear she cannot hear the lower whispered sounds. *III 3* has a progressive hardness of hearing, especially in the right ear; it was first noticed at the age of 21. The cause has not been determined. Headaches appeared irregularly, but there were no dizzy spells. The patient has constant tinnitus and has undergone an operation on the nasal septum. Conversation became difficult to hear at the age of 34. *III 3* was in the Clark School for the Deaf (Dr. Duel's case).

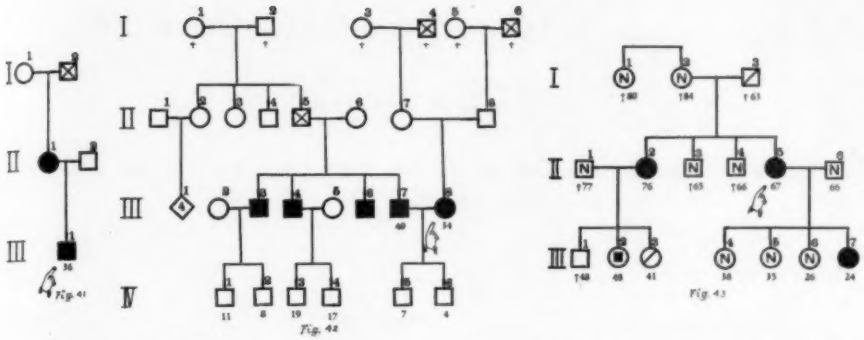


Fig. 41.—A family referred from the Manhattan Ear, Eye and Throat Hospital through Dr. Harris.

Fig. 42.—A family of prevailingly British stock (referred from the Volta Bureau; data obtained by correspondence). *I 4* had deafness which was thought to have followed scarlet fever. *I 6* was totally deaf at 80 years of age. *II 5* was deaf at 50 years of age. *III 3* was deaf at 25 years, and almost totally deaf at the age of 50. In *III 4* deafness was thought to have begun at about 6 years of age. *III 6* had deafness which began at 20 years of age. Generation *IV* is too young to show otosclerosis.

Fig. 43.—A family of prevailingly English stock, living chiefly in the eastern part of the United States. *I 3* was deaf in 1 ear in middle life. The deafness was thought to be caused by working in a noise. *II 2* has had progressive hardness of hearing since the age of 23; it started without apparent cause. She has had a loss of hearing after each pregnancy, but no headaches, dizzy spells or sore throat and very little tinnitus. The teeth decay easily. Some paracusis is present. The condition has been diagnosed as otosclerosis. *II 5* has a progressive hardness of hearing which was first noticed at about the age of 18 and which was ascribed to measles. She has had a discharge from the ear, loss of hearing after each pregnancy, a few headaches and dizzy spells, marked tinnitus and frequent sore throat and colds but no sinus trouble. Her teeth decay rather easily and she suffers from paracusis. The deafness has been diagnosed as otosclerosis. *III 3* has a deafness which is worse in the right ear and was first noticed at about 16 years of age. No immediate cause has been assigned. There is a history of discharge from the ear. The patient has no headaches and few dizzy spells; originally there was some tinnitus. She has a tendency to sore throat and colds and to decay of the teeth. No paracusis is present. The deafness is ascribed to a perforated ear drum.

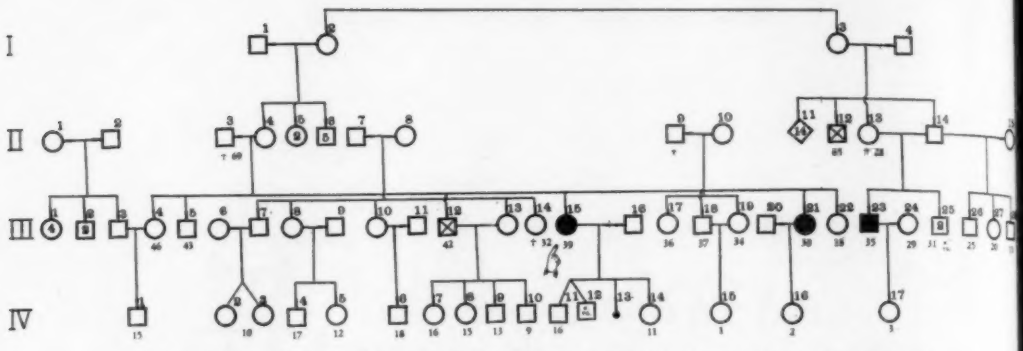


Fig. 44.—A family of prevailingly German stock (referred from Dr. Crowe's clinic). *II 12* is said to be hard of hearing.

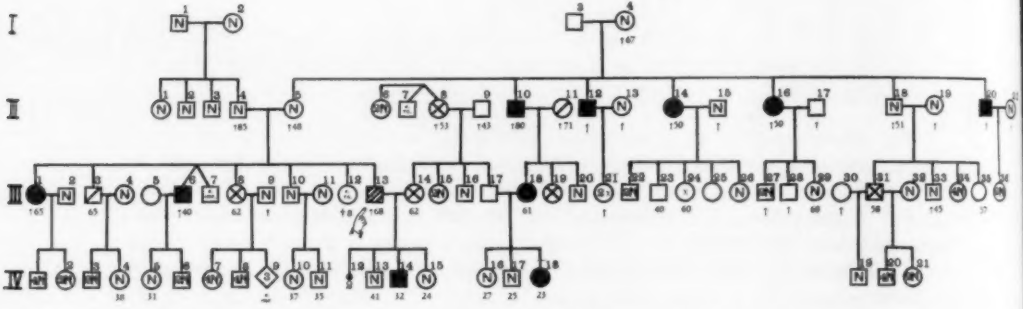


Fig. 45.—A family of prevailingly English and Irish stock (referred from Dr. Crowe's clinic at Johns Hopkins Hospital). *II 8* is said to have been hard of hearing as long as his daughter could remember. *II 10* has had progressive hardness of hearing as long as his daughter can remember; it began before the age of 30. He suffers from tinnitus and occasional dizzy spells, but few colds and no sinus or mastoid trouble. The teeth are good. *II 11* became hard of hearing toward the end of her life. *II 12* has the same history as *II 10*. *II 14* was very hard of hearing before her death; her history was the same as that of *II 10*. *II 16* is said to have had the same history as *II 10*. *II 20* was very hard of hearing at the time of his death. The history of his defect said to be the same as that of *II 10*. *III 18* has a hardness of hearing which is worse in the left ear and which was first noticed as a child. She has had no discharge from the ears, no headaches, occasional dizzy spells and tinnitus; no loss of hearing occurred after pregnancy. Her teeth are resistant and she has paracusis. *III 19* is said to have had a hardness of hearing almost all of her life, with a tendency to dizzy spells and tinnitus; she also suffers from paracusis. *III 31* has a hardness of hearing which was first noticed at the age of 32, following a bad cold. The deafness has been stationary since the age of 43. No earaches, discharge from the ears, paracusis or tinnitus is reported, but he has occasional dizzy spells. His teeth decay easily; false ones were acquired at 50. The Rinne test gave negative results on the right and slightly negative results on the left. *IV 18* has a progressive hardness of hearing, first noticed at the age of 13 years, no discharge, few headaches, frequent dizzy spells and tinnitus, and paracusis. Negative results were obtained in the Rinne test.

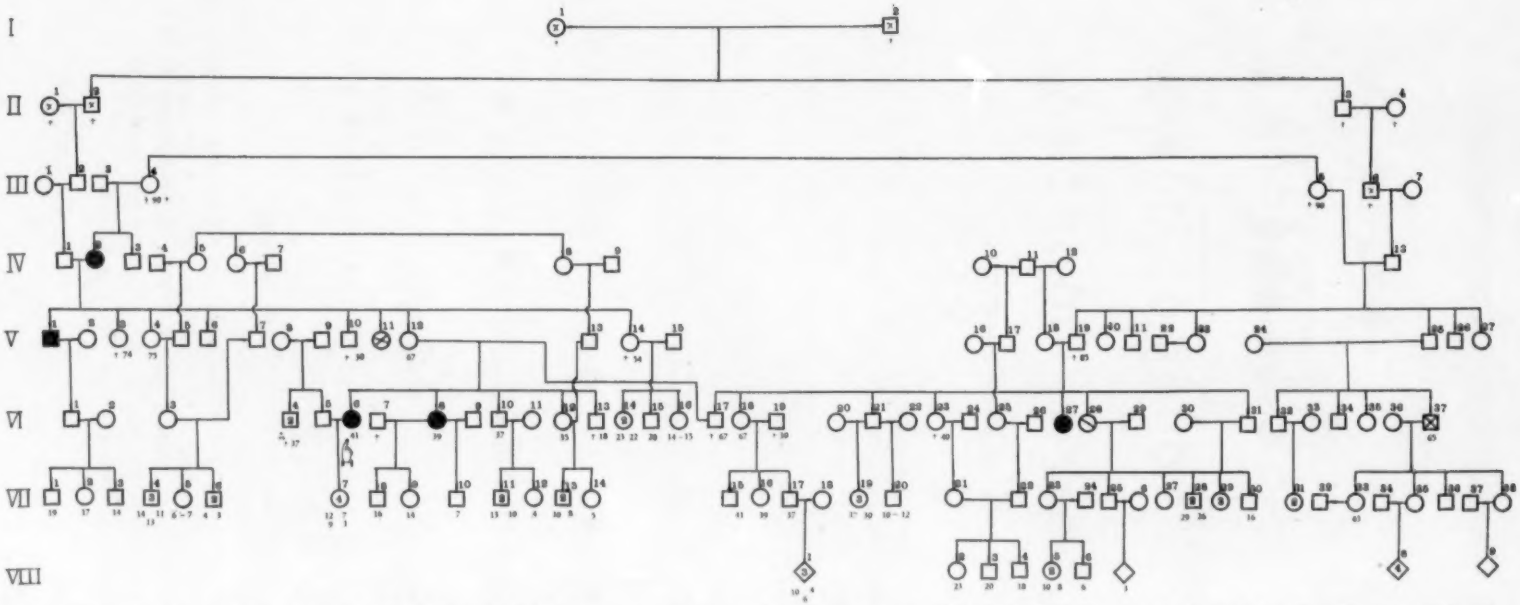


Fig. 46.—A family of mostly French and English stock, living in the eastern part of the United States (referred by Dr. Duel). *VI 37* has a progressive deafness, which is worse in the right ear; it began at the age of 60 and has been worse during the last two years; he has no vertigo but a slight tinnitus.

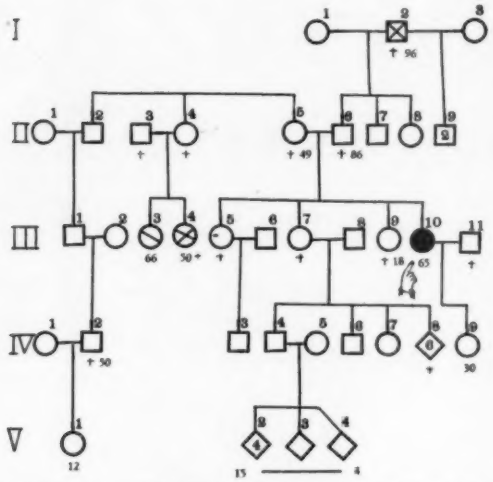


Fig. 47.—A family of prevailingly English stock, living in the eastern part of the United States (referred from the Volta Bureau).

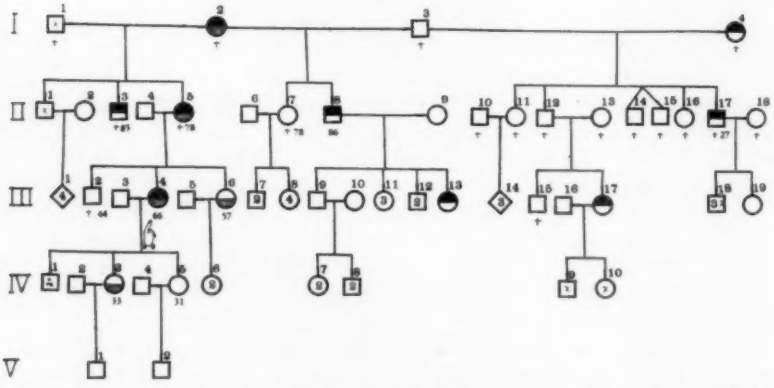


Fig. 48.—An English family living in the Mississippi Valley (data obtained from Dr. Bess Lloyd Milles by letter from Chicago). *I 2* was hard of hearing at the time of her death. She had blue sclerotics. *I 4* had partial deafness of unknown type. *II 3* was almost totally deaf at death. He had had a hardness of hearing since early middle age. *II 8* had been quite deaf for many years before his death. *II 17*, who was killed in the Civil War, had beginning deafness. *III 13* has a slight deafness at the age of 66. *III 17* is very deaf at 45 years of age. *IV 3* has very blue sclerotics but no defect of hearing.

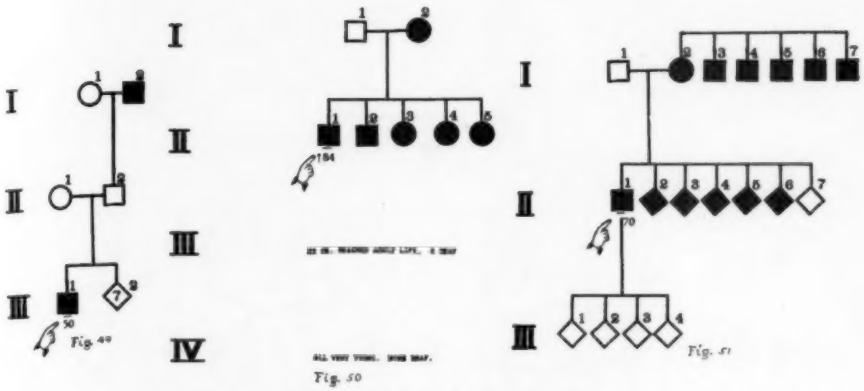


Fig. 49.—A family reported by Albrecht (1922, case 3). No other cases of hardness of hearing were known.

Fig. 50.—A family reported by Amadon (1912, p. 927). *I 1* was believed not to be deaf. *I 2* was deaf. *II 1,* the patient, had deafness diagnosed as otosclerosis on the basis of both symptoms and pathologic observations. *II 2,* a brother, and *II 3, 4* and *5,* 3 sisters of the patient, were all very deaf. In the third generation there were 22 children who had reached adult life; only 4 of them were deaf. In the fourth generation the children were all very young; none of them was deaf.

Fig. 51.—A family reported by Amadon (1912, p. 937). No statement was obtained concerning the hearing of *I 1. I 2-7* were all very deaf from their youth. *II 1,* the patient, had deafness diagnosed as otosclerosis. *II 2-6,* 5 siblings, were deaf like the eldest brother. *II 7* was probably not deaf. *III 1-4,* 4 adult children of *II 1,* had normal hearing.

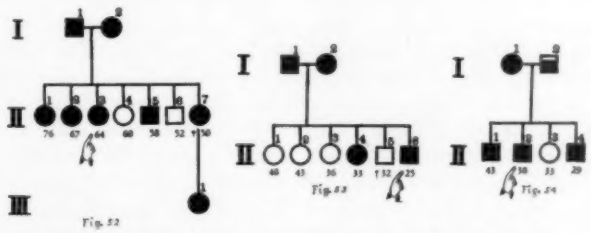


Fig. 52.—A family reported by Bauer and Stein (1925, chart 6).

Fig. 53.—A family reported by Bauer and Stein (1925, chart 7).

Fig. 54.—A family reported by Bauer and Stein (1925, chart 8).

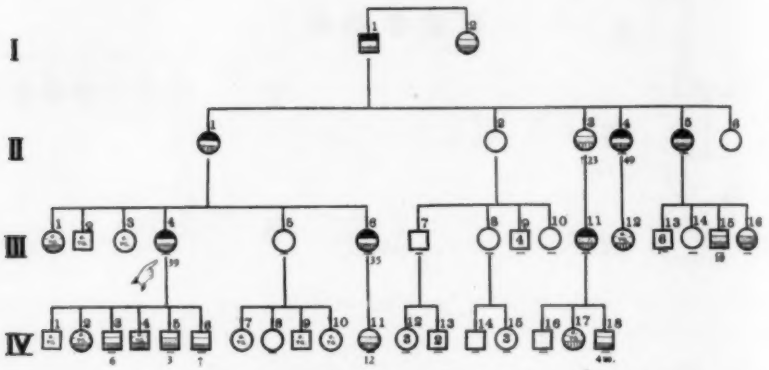


Fig. 55.—A family reported by Bronson (1917, chart 1, the Currie family). *I 1* was moderately deaf, had suffered many fractures and had deep blue sclerotics. *I 2* had deep blue sclerotics, and had a history of fractures. *II 1* was very deaf, had blue sclerotics and was subject to fractures. *II 2* had normal hearing and white sclerotics. No fractures were reported. *II 3*, who died at the age of 23, was not deaf, but had blue sclerotics and had had fractures. Bronson stated that *II 4* had been growing deaf since adolescence. Fraser, who also examined her, said that the deafness started eight years before, following a cold. *II 4* stated that she was unable to hear for a week at that time and was miserable. When the cold went away, the hearing in the left ear improved to some extent. She had never had otorrhea. She suffered from tinnitus and heard better in a noise. The sclerotics were of a deep grayish-blue. Fractures were reported. *II 5* had been somewhat deaf since girlhood and had had fractures. She showed blue sclerotics. *II 6* had experienced no fractures and had white sclerotics. *III 7-10* had normal hearing and showed no characteristics of fragilitas ossium. In *III 11* the hearing was somewhat defective. Her bones fractured easily and she had the bluest sclerotics in the family. *III 12*, who died in early infancy, had blue sclerotics but no history of fractures. *III 13* and *14* had no fractures. Their eyes were normal. *III 15*, aged 10, had suffered fractures and had moderately blue sclerotics. *III 16* had deep blue sclerotics and presented a history of fractures. *IV 1* died in infancy. *IV 2* and *4*, who also died in infancy, had blue sclerotics. *IV 3*, aged 6, had experienced no fractures, but had moderately blue sclerotics. *IV 5*, aged 3, had a tendency toward fractures and showed blue sclerotics. *IV 6*, who died while the family was under observation, had blue sclerotics. *IV 7-10*, who died in infancy, had white sclerotics and no fractures. *IV 11*, aged 12, had blue sclerotics and a tendency toward fractures. *IV 12-15* had white sclerotics and had no tendency toward fractures. *IV 16* had had no fractures and showed white sclerotics. *IV 17*, who died in early infancy, had deep blue sclerotics. *IV 18*, aged 4 months, had blue sclerotics. Examination of *II 4*, *III 4* and *III 6* by Fraser showed a very similar condition, which was probably otosclerosis. Seven members of the family had deafness which started in early adult life and grew steadily worse. None became completely deaf. No member without fragilitas ossium and blue sclerotics had any deafness.

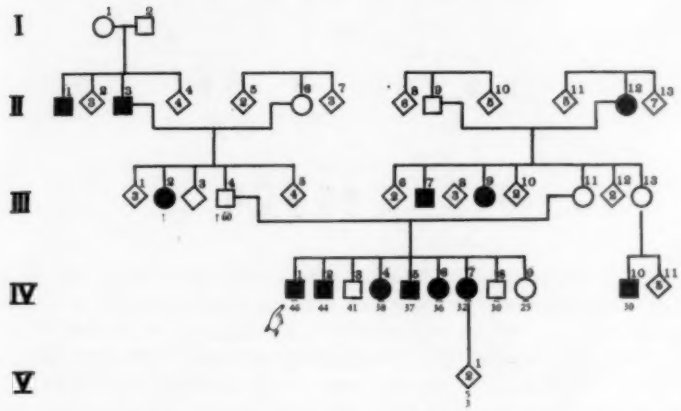


Fig. 56.—A family reported by Gray (1917, table II).—In the families of *I 1* and *2*, deafness was absent, so far as could be ascertained, but the possibility of obtaining reliable evidence was remote. *II 1* was not noticeably deaf before the age of 60. *II 3* showed dulness of hearing comparatively late in life. *II 5-7*, 6 siblings, showed no deafness. *II 8-10*, a family of 12, had no deafness. Of *II 11-13*, 13 siblings, 1 was deaf. *II 12*, the affected member, did not become deaf until the age of 50. *III 1, 3* and *5* were not affected. *III 2* was the only one in a family of 10 who was affected. She became deaf in middle life. *III 4* was not deaf when he died at the age of about 60. *III 6-13*, a family of 13, had normal hearing except for 2 members (*III 7* and *9*), who had dull hearing in middle life. *IV 11* showed normal hearing. *IV 10* was deaf. *V 1* showed no defect of hearing, but these 2 children were too young to show otosclerosis. Of more than 40 first and second cousins on the father's side, none was deaf. Out of more than 30 first and second cousins on the mother's side only 1 was deaf (*IV 10*). On both the paternal and the maternal sides there was a slight tendency toward otosclerosis. Gray stated that 6 of generation *IV* actually suffered from otosclerosis.

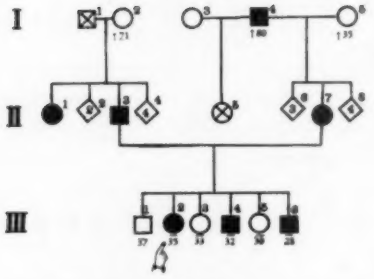


Fig. 57.—A family reported by Gray (1917, table III).—*I 1* was slightly deaf between the ages of 55 and 60. *I 2* was not deaf when she died, at the age of 71. *I 3* was not deaf. *I 4* began to be deaf between the ages of 55 and 60. The dulness increased until he was very deaf when he died, at 80 years of age. *I 5* was not deaf when she died, at 35 years of age. In *II 1*, deafness made its appearance between the ages of 50 and 60. *III 2* had constant tinnitus, which was surging in character; it made its first appearance four years after the onset of deafness in the left ear. More recently tinnitus of a booming character had been heard in the right ear. Paracusis was marked. On rare occasions slight attacks of giddiness were observed. These occurred not oftener than once a year, but were associated with a temporary increase in the tinnitus. Deafness first appeared at the age of 25; at that time, the patient was distinctly anemic and was breathless on exertion. On treatment of the anemia, the general condition greatly improved, and the deafness made no further advance until the age of 30. Since then there had been a slow increase both in the deafness and in the intensity of the tinnitus. On examination by the author, the patient was found to have otosclerosis! In *III 4* neither tinnitus nor paracusis was present. The latter was absent owing to the fact that 1 ear had normal hearing power. Dulness of hearing began gradually and without known cause between the ages of 29 and 30. Within three years of the examination that showed the left ear only to be affected, the right became affected. The patient was examined by the author and found to have otosclerosis! In *III 6* tinnitus was occasionally present, was slight in degree and was felt to be in the head rather than in the ears. Paracusis was not observed, the hearing in the left ear being still too good for the occurrence of this symptom. Dulness of hearing began in the right ear at the age of 22 and in the left ear at the age of 24. The onset in both ears was gradual and without known cause. Examination by the author showed otosclerosis! There were, in all, about 40 first cousins of the present generation and only 1 of these was deaf. Of many second cousins (number not known), only 2 were deaf, but it is significant that these 2 were brothers. They were on the paternal side.

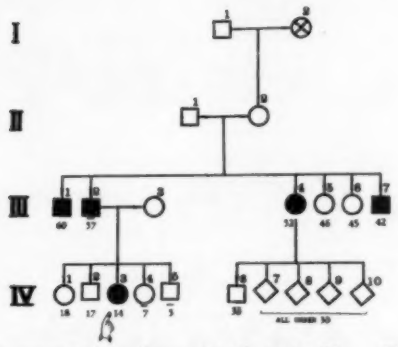


Fig. 58.—A family reported by Gray (1917, table V). *III 2* showed no history of giddiness or any symptoms pointing to disease of the vestibule or semicircular canals. Tinnitus was not complained of. About fifteen or twenty years before, however, he noticed it for several months or a year, but the symptom passed away and was not distressing. Paracusis was marked and had been so for at least fifteen or twenty years. Deafness began gradually and without known cause at about the age of 31. No pain or discharge occurred at any time. Both ears were affected at approximately the same time. Recently the deafness had become distinctly worse. It is quite possible that this was associated with degenerative changes in the sound-perceiving apparatus. The bone conduction for low notes was still above normal, but the hearing power for the high notes was seriously affected. The Rinne test gave negative results. *IV 1* and *2* had unaffected hearing. *IV 3* had otosclerosis! Tinnitus of a hissing character was present, but paracusis had not yet been observed, since the dulness of hearing was not yet sufficiently pronounced. It probably appeared as deafness increased. Dulness of hearing was first noticed about a year before the examination. It was of gradual onset, and there was never any pain or discharge. The patient first noticed the tinnitus a few months after the dulness of hearing was suspected. The results of the Rinne test were negative. *IV 4* and *5* had unaffected hearing. *IV 6-10* showed normal hearing, but the oldest was only 30 years of age, and it is possible that otosclerosis made its appearance later in some members of the family. The author stated that he had little doubt that in the course of time other members of the family would fall victims to the disease, as although none of the members had yet reached the usual age for the appearance of otosclerosis, one of them already manifested the condition unmistakably. Generation *III* was heavily burdened with otosclerosis.

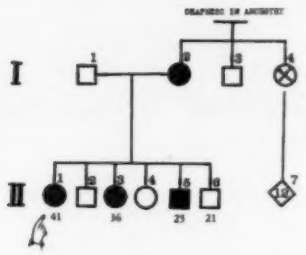


Fig. 59.—A family reported by Gray (1917, table VI).

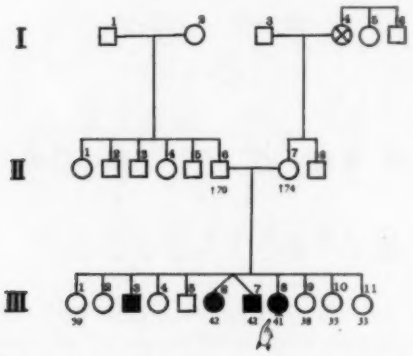


Fig. 60.—A family reported by Gray (1917, table VII). *I 1* and *2* were not deaf nor was there any record of deafness among their relatives. *I 3* was not deaf, even in comparatively old age. Nothing known of his family. *III 6* and *7* were not identical twins.

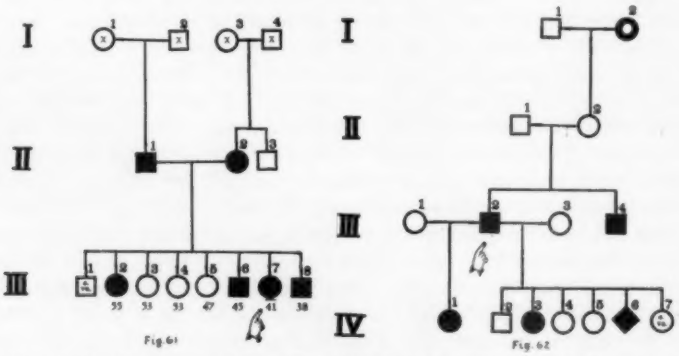


Fig. 61.—A family reported by Gray (1917, table VIII). Nothing was known of generation *I*. *III 2* attributed her deafness to scarlet fever; in a sense this may have been correct but there was no history of pain in the ear during the scarlet fever, or of any suppuration. Two possible causes were: (1) adhesive processes occurring after scarlet fever and (2) otosclerosis, scarlet fever being merely the exciting cause in a person showing a marked familial tendency toward otosclerosis. *III 6* was deaf. The author stated that there was little doubt that this was a case of otosclerosis occurring in a family in which there was marked tendency toward the disease, though possibly an accident may have been the exciting cause. *III 7* had typical otosclerosis! While there may have been an exciting cause, it alone could not produce otosclerosis, unless there was an inherited tendency to the disease. Dulness of hearing on the left was so slight that the patient was unaware of it. Slight tinnitus had been present for a few weeks. Nasal catarrh and damp weather did not affect the hearing, but exhaustion made it worse.

Fig. 62.—A family reported by Gray (1917, table XI). *I 2* was a deaf-mute. It is not known whether this condition was acquired or inherited. *II 1* and *2* were not deaf. No inference can be drawn as to whether the otosclerosis which appeared later (after *I 2*) in the family tree was associated with deaf-mutism or not.

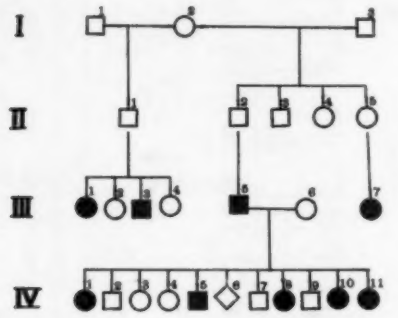
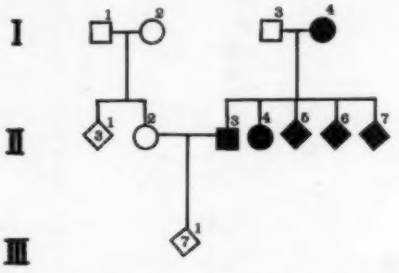


Fig. 63.—A family reported by Gray (1917, table XIII). *I 1, 2* and *3, II 1,* and *II 2-5* were not deaf. *III 1, 3, 5* and *7* and *IV 1, 5, 8, 10* and *11* were otosclerotic.



. Fig. 64.—A family reported by Gray (1917, table XIV). *I 1* and *2* were not deaf. *III 1* showed no deafness, although all 7 had reached the age at which otosclerosis usually appears.

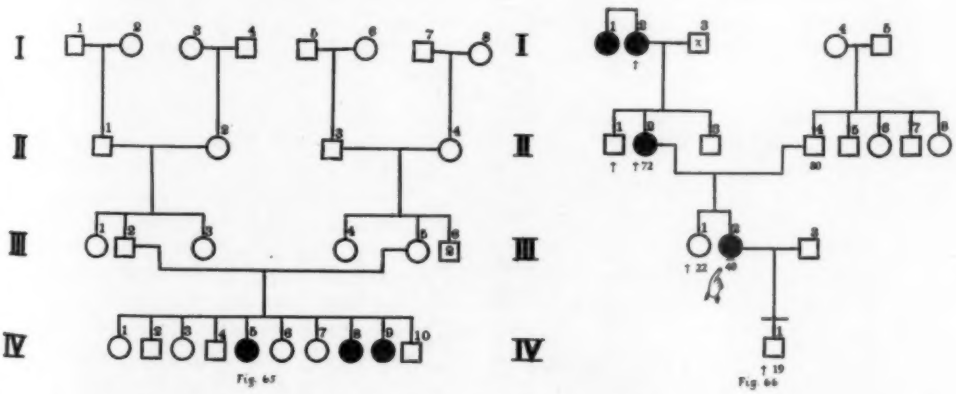


Fig. 65.—A family reported by Gray (1917, table XV).

Fig. 66.—A family reported by Haike (1927-1928, pedigree Ne). *IV 1* was the only child of *III 2* who was mentioned. He died of tumor of the brain at 19 years of age. This family showed a remarkable accumulation of gout, nervous diseases, cancer, tuberculosis and a degenerative state.

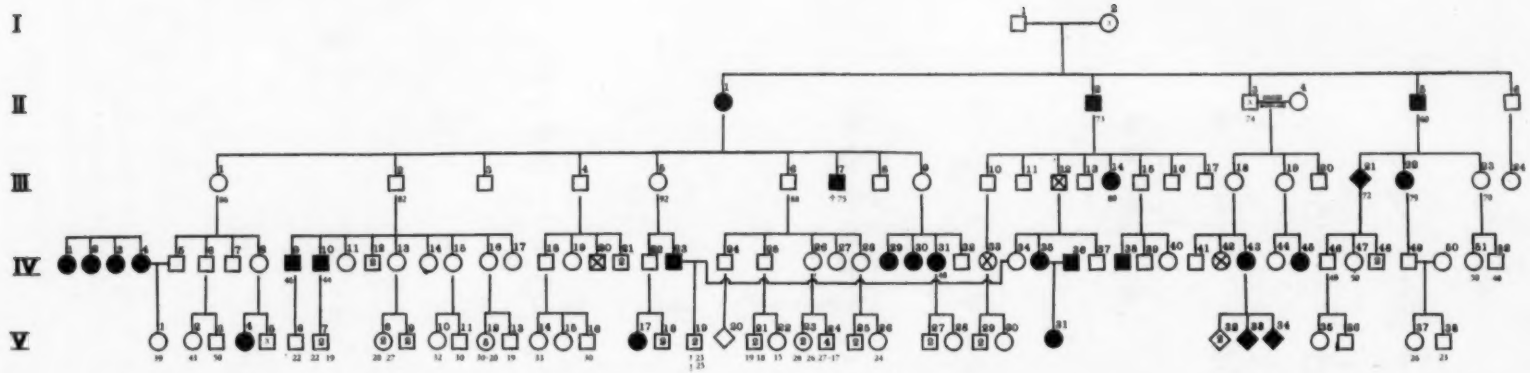
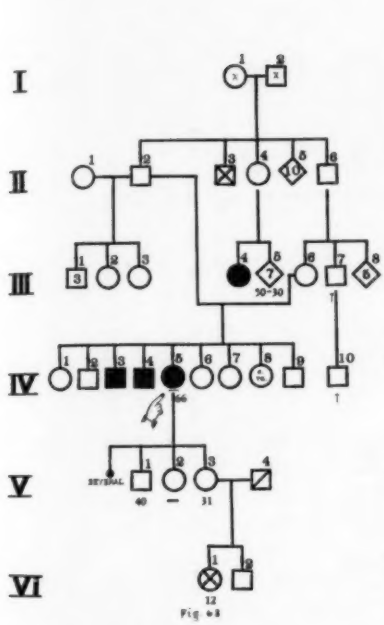


Fig. 67.—A family reported by Haike (1927-1928, pedigree Sa). *I 2* introduced defective hearing into the family, but whether she was deaf or whether deafness was only known to be present in her family could not be determined from the records. Concerning *II 3* the data were contradictory. *II 3* and *4* were cousins. *III 14* was extremely hard of hearing. *III 21* and *22* were hard of hearing. *IV 5-8* had sound hearing. *IV 23, 29, 30* and *35* were hard of hearing. *IV 43* and *45* probably had otosclerosis. *IV 20, 33* and *42* had a hearing defect of undetermined nature. *IV 22* was mentioned as being in this same group, but was not marked on the chart. *IV 46, 47* and *48* were normal. *V 1* had sound hearing. *V 4* was afflicted with deafness before the age of 20. *V 17* was afflicted at the end of her thirties. Of *V 25* (2 sons) the older was 25 years of age and the other was younger than the sister (*V 26*). *V 33* and *34* were hard of hearing.



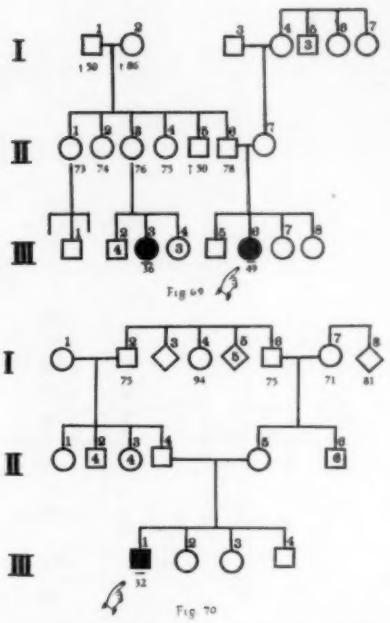


Fig. 68.—A family reported by Haike (1928, pedigree Ma). *III 1-3* had normal hearing. *III 5*, aged from 50 to 30, had sound hearing. *V 1-3*, aged 40 to 31, had normal hearing. *V 4* suffered from chronic otitis media. *VI 1* had had inflammation of the middle ear several times. Afterward she had a slight loss of hearing in the right ear (the result of the disease of the middle ear or the beginning of otosclerosis?). There was a history of cancer and cardiac disease in the family.

Fig. 69.—A family reported by Haike (1928, pedigree Ri). *II 5* committed suicide at 50 years of age. *II 1* was believed to have had 3 children, but nothing is known about 2 of these. *III 3* had dulness of hearing in the left ear several years before. The hearing was better after treatment. Half a year before, she had a nervous breakdown and her hearing decreased considerably. The Rinne test gave positive results on both sides. Bone conduction was lengthened on the right. The Weber test was referred to the right. The diagnosis was tubular catarrh on the right side. She was under treatment again in her fifty-sixth year and said that for nine years she had heard poorly in the left ear and that it had gradually grown worse. The Weber test was referred to the left. Bone conduction was lengthened on the left and normal on the right. The Rinne test yielded positive results on the right and negative results on the left. The diagnosis was otosclerosis on the left side! This family was severely afflicted with malignant tumors, ocular disease and rheumatism.

Fig. 70.—A family reported by Haike (1928, pedigree Co). No disturbance of hearing was reported in any other member of the family than *III 1*.

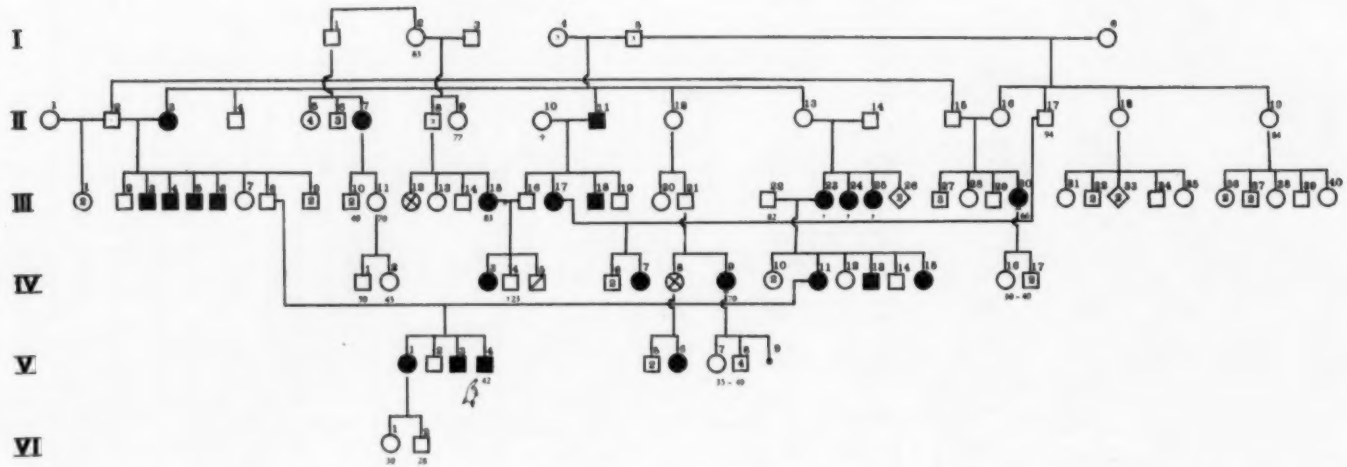


Fig. 71.—A family reported by Haike (1928, pedigree Be). *I 5* was married twice, first to *I 4* and then to *I 6*. *III 1* had normal hearing. *III 12* had been hard of hearing since 40 years of age. The cause of the deafness was unknown. The fraternity *III 23-26* was given in Haike's secondary table B. This apparently was copied directly from an earlier article published in 1927-1928, in which it was described as being composed of 2 males and 3 females none of whom was affected. *V 4* had hardness of hearing which began at 29 years of age. After a fracture of the base of the skull he could scarcely hear with an electric apparatus. Dizzy spells had occurred since the accident. The diagnosis of otosclerosis made by Manasse in 1923 was confirmed by the author's examination, which also showed some involvement of the middle ear! Many of the members of this family were afflicted with cancer.

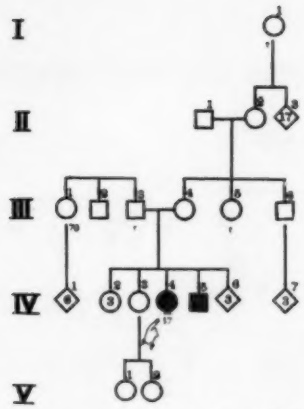


Fig. 72.—A family reported by Haike (1928, pedigree Th).

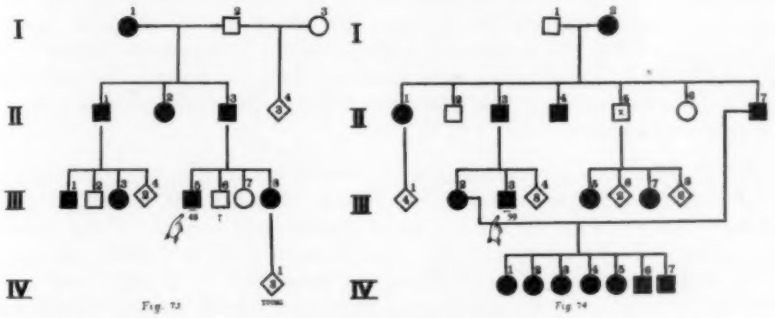


Fig. 73.—A family reported by Hammerschlag (1905, table I). *I 1* was moderately hard of hearing. *I 2* and *3* had normal hearing. *II 4* had normal hearing. *III 1* was moderately hard of hearing. *III 2* and *7* were normal. *III 3* and *8* were hard of hearing. The others in this generation (*III 4*) were children. The members of the fourth generation (*IV 1*), all young, were normal.

Fig. 74.—A family reported by Hammerschlag (1905, table II). *II 2* and *6* were normal. Each had several normal children. *II 4* had progressive hardness of hearing but had normal children. *III 1, 4, 6* and *8* were normal. *III 5* and *7* were moderately hard of hearing.

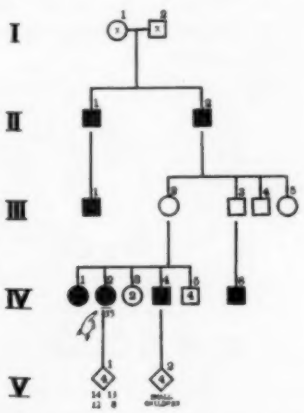


Fig. 75.—A family reported by Hammerschlag (1906, fig. II). *II 1* and *2* were hard of hearing. *IV 6*, by hearsay, was hard of hearing. The members of the fraternity *V 1* had not yet reached the critical age. The fraternity *V 2* comprised small children.

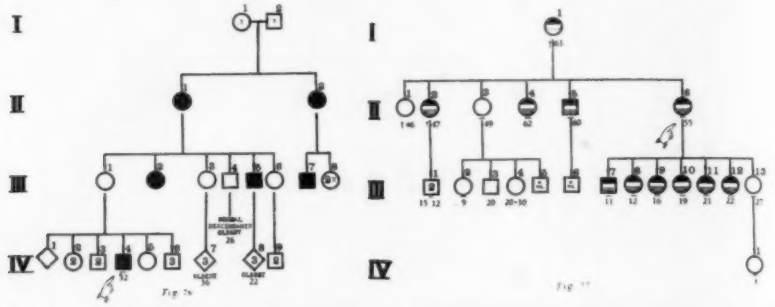


Fig. 76.—A family reported by Hammerschlag (1908, pedigree IX). *II 1* and *2* had bilateral hardness of hearing. *III 2* was deaf in the right ear. The descendants of *III 4* had normal hearing. The oldest was 26. *III 5* was deaf in the left ear. *III 7* was bilaterally deaf. Nothing is known in respect to the hearing of *III 8*. *IV 7* had normal hearing. The oldest was 36 years of age. *IV 8* had normal hearing. The oldest was 22. The fraternity *IV 9* was normal. The ages are unknown.

Fig. 77.—A family reported by van der Hoeve and de Kleyn (1918, family X). *II 2* had been very deaf since 20 years of age. She had had 3 fractures. *II 4* had been deaf since the age of 30. Loud tinnitus was present. Three fractures had occurred. *II 6* showed deafness which began in youth and which was accompanied by loud tinnitus. Two fractures had occurred. *III 1* and *2* had normal hearing. In *III 3* and *4* the condition of the hearing is not known. No fractures or blue sclerotics were recorded. *III 5* died at 9 months of age; no further information is available. *III 6* was born dead. *III 7* showed a variation in hearing which was so slight that she was not conscious of it. Tinnitus was present. *III 8* had a slight hearing defect like that of *III 7*. She did not suffer from tinnitus, but had had 2 fractures. *III 9* had a hardness of hearing which began at 15 years of age. No tinnitus was reported. *III 10* had hardness of hearing but no tinnitus. She had had 11 fractures. *III 11* was hard of hearing and had slight tinnitus. She had had 11 fractures. *III 12* had hardness of hearing which began at 17 years of age. Tinnitus was loud in the right ear and very loud in the left ear. Nineteen fractures were reported. *IV 1* had normal hearing. Deafness in all cases was found to be of the otosclerotic type, with some labyrinthine involvement in the more advanced cases.

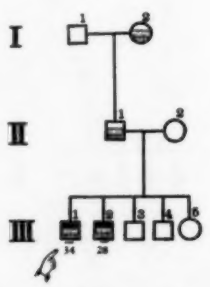


Fig. 78.—A family reported by Kompanejetz (1930, cases 1 and 2).

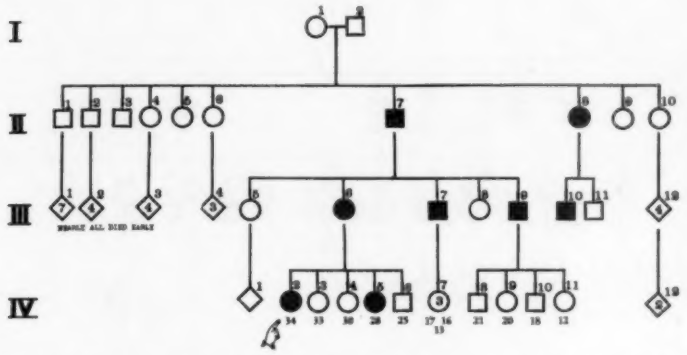


Fig. 79.—A family reported by Körner (1905, I). Nearly all of the fraternities *III 1-3* died early of consumption and all without descendants. *III 6, 7, 9* and *10* had otosclerosis.

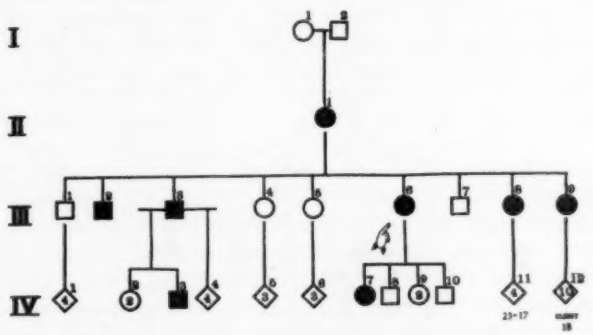


Fig. 80.—A family reported by Körner (1905, II). Most of the children of generation *IV* were too young to show symptoms of otosclerosis.

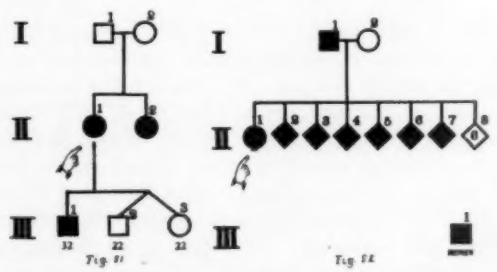


Fig. 81.—A family reported by Körner (1905, III).

Fig. 82.—A family reported by Magnus (1876).

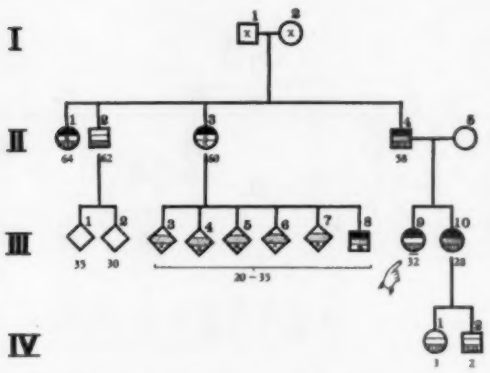


Fig. 83.—A family reported by Ruttin (1922, family N). *II 1* had had poor hearing since her youth, and showed blue sclerotics. Nothing was mentioned about fractures. *II 2* had good hearing. He had had no fractures but had blue sclerotics. *II 3* had had poor hearing since youth. It is not known whether she had blue sclerotics or fractures. *III 1* and *2* had good hearing and no blue sclerotics or fractures. *III 3-7* had normal hearing, but frequent fractures. Nothing could be learned about their sclerotics. *III 8* had defective hearing, and suffered frequent fractures. Nothing was known about his sclerotics.

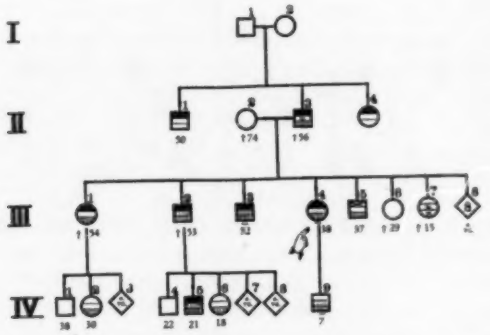


Fig. 84.—A family reported by Ruttin (1922, family S). This pedigree is given here much as it was given by Ruttin. It was also given by Hass as family D. *I 1* was not hard of hearing. *II 1* was hard of hearing at 50. *II 4* was hard of hearing later in life than her brother *II 1*. *III 8* comprises 8 or 10 children who died early. *IV 1* had good hearing and no blue sclerotics or fractures. *IV 2* had good hearing and no tendency toward fractures, but showed blue sclerotics. *IV 3* died at 14 days of age. *IV 4* had good hearing and no blue sclerotics or fractures. *IV 5* had difficulty in hearing and a tendency toward fractures. He also had blue sclerotics. *IV 6* had good hearing and no tendency toward fractures, but showed blue sclerotics. *IV 7* died at 8 days of age. *IV 8* died at 6 years of age. *IV 9* had good hearing, but had blue sclerotics and a tendency toward fractures. Many of the members of this family died of cardiac disease. Hass did not show as many cases of blue sclerotics and fractures in the last generation as Ruttin did.

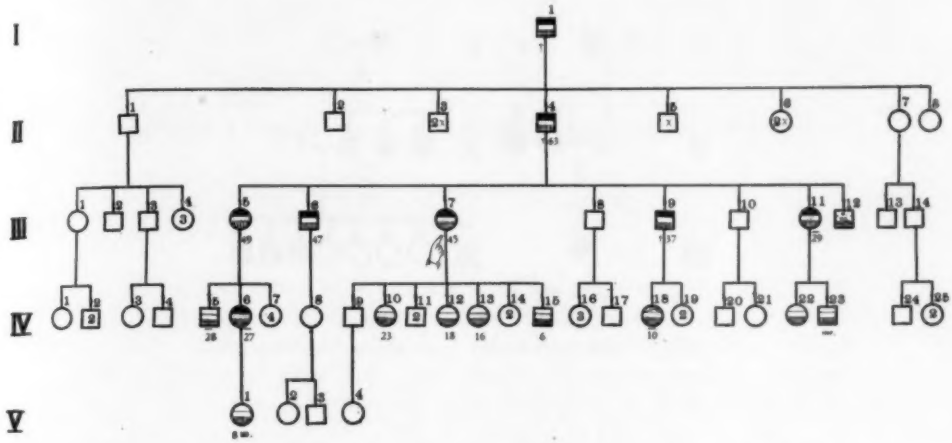


Fig. 85.—A family reported by Stobie (1923, fig. 1).—*I 1,* who died in old age, was reported to have been very deaf. The date of onset of the deafness was unknown. No information could be obtained concerning *II 3, 5* and *6*. In *IV 5* the ears were normal but there was deafness caused by wax. The teeth were pulled as bits kept breaking off. In *IV 6* the upper and lower incisors chipped at the edges. She had been getting deaf for two years and often felt giddy. The condition was diagnosed as otosclerosis! *IV 10* was not deaf. Twelve teeth were missing which broke off while she was eating. Of 2 siblings (*IV 11*), 1 was less than 6 years old. In *IV 12* the tone range and acuity for all tones were normal. *IV 13* and *15* were not deaf. *IV 18* was always noticeably deaf. The results of hearing tests were not sufficiently marked to justify the opinion that deafness was due to any permanent cause. Hearing was defective for the sound of a watch and for the conversational voice, as her family had remarked, but she could hear the full tone range. Moreover, the Rinne test was still positive and bone conduction was not prolonged. The teeth were good. There was a slight degree of exophthalmos. *IV 22* had good teeth. *IV 23* was born June 12, 1923. *V 1* had good teeth and was apparently not deaf at the age of 8 months. None of the members of the family with normal sclerotics showed deafness.

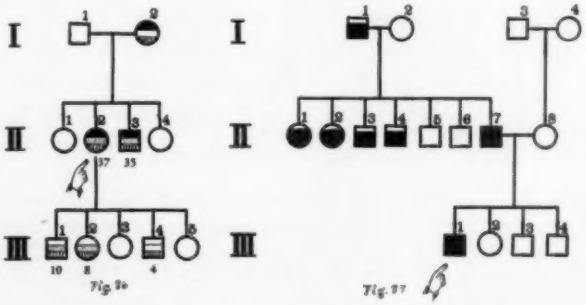


Fig. 86.—A family reported by Straat (1923). *III 1* and *2* were not deaf.

Fig. 87.—A family reported by Undritz (1928, no. 34).

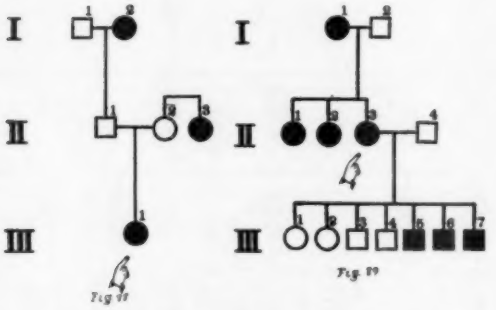


Fig. 88.—A family reported by Undritz (1928, no. 38).

Fig. 89.—A family reported by Wojatschek (1925, table IV-1). Observations of M. S. Michelovitch on a family showing otosclerosis.

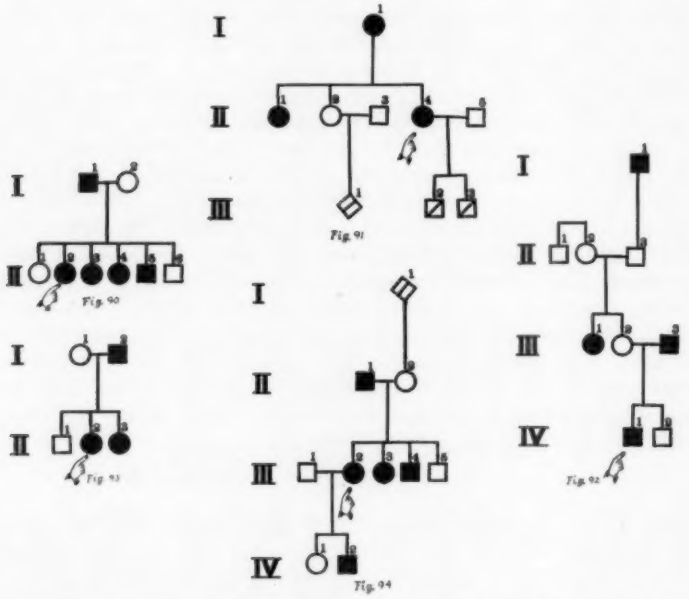


Fig. 90.—A family reported by Wojatschek (1925, table IV-2). Observations of M. S. Michelovitch on a family showing otosclerosis.

Fig. 91.—A family reported by Wojatschek (1925, table 7, part 14).—*III 1* had chronic suppurative otitis. *III 2* and *3* had acute suppurative otitis.

Fig. 92.—A family reported by Wojatschek (1925, table 7, part 17).

Fig. 93.—A family reported by Wojatschek (1925, table 7, part 18).

Fig. 94.—A family reported by Wojatschek (1925, table 7, part 19).

SO-CALLED THYMIC DEATH

V. RESPIRATORY SENSITIZATION TO GENERAL AND LOCAL ANESTHETICS

GEORGE L. WALDBOTT, M.D.
DETROIT

In 1924, a committee of the Section on Laryngology, Rhinology and Otology of the American Medical Association investigated sudden death during local anesthesia. Its report, presented by Mayer,[1] mentioned forty-three such accidents. In some of these cases, apparently, an overdose was given, and there was evidence of typical cocaine poisoning. There were a few with advanced myocardial changes which may have accounted for death. In others, however, no reason for sudden death could be discovered, particularly in those in which the drug was applied locally to the nasal mucous membranes without an injection. In eleven of twenty cases which came to autopsy, the various pathologists reported thymic hyperplasia and enlargement of lymphoid glands. In most instances there was a complete lack of understanding of the mode of death. The medical literature contains numerous other instances of sudden death during local and general anesthesia which cannot be explained on the basis of the pharmacologic and toxicologic action of the drug administered. As a rule, within a few minutes after the administration of the anesthetic, before any surgical procedure has been instituted, the patient becomes dyspneic and dies.

I have recently studied [2] the pathologic changes in twelve cases of what has been termed "thymic death," four of which occurred during ether anesthesia. During the course of this work, certain pathologic and clinical features were brought out which indicate a marked resemblance to, if not an identity of this condition with, anaphylactic death as it is observed following injections of pollen and serum.[3]

Some of the most thorough students of so-called "thymic death" have discarded the anaphylactic theory, "since death occurs after the injection of nonprotein material as well" (Marine [4]). In view of the

1. Mayer, E.: The Toxic Effects Following the Use of Local Anesthetics, J. A. M. A. **82**:876 (March 15) 1924.

2. Waldbott, G. L.: The Pathology of So-Called Thymic Death: A Study of Twelve Cases; Preliminary Report; The Genesis of Thymic Death, Klin. Wchnschr. **11**:1960 (Nov. 19) 1932.

3. Waldbott, G. L.: Systemic Reactions from Pollen Injections, J. A. M. A. **96**:1848 (May 30) 1931; The Prevention of Anaphylactic Shock: With a Study of Nine Fatal Cases, J. A. M. A. **98**:46 (Feb. 6) 1932.

4. Marine, D.: Status Lymphaticus, Arch. Path. **5**:661 (April) 1928.

work of Landsteiner [5] and of Avery and co-workers,[6] this objection cannot stand any longer. It has definitely been demonstrated by these investigators that so-called "nonantigens" such as simple chemical substances may act as antigens. In fact, in certain bacteria it is a carbohydrate and not a protein which determines their antigenic properties. I have collected a series of cases of human anaphylactic shock [7] following administration of substances other than protein and demonstrated that any substance which produces allergic symptoms, whether it contains protein or not, may also produce human anaphylactic shock, provided three conditions are fulfilled: an extreme degree of sensitivity, a dose above the patient's tolerance and a rapid absorption of the antigen. The clinical manifestations are the same no matter what the material that causes the shock.

Since a large percentage of cases reported in the literature which have been diagnosed as so-called "thymic death" occurred during local and general anesthesia, and since, on the other hand, sensitization to ether and local anesthetics has received little attention, I believe it is of greatest importance to report any experience contributing to this question.

The greatest difficulty encountered in the report of such instances is the well known fact that skin tests cannot be depended on nor can the passive transfer test (Prausnitz-Kustner) be successfully applied, because it is usually impossible to demonstrate the respective reagins. The only means of approach, therefore, are careful clinical observation and correlation of facts.

Probably the best known evidences of sensitization to cocaine, procaine and similar chemicals are cutaneous manifestations, particularly in the form of contact dermatitis and urticaria. I have recently reported a case of an asthmatic person [8] who had been completely free from attacks of asthma for two years, until a local application of cocaine to the nasal mucosa produced immediately a severe attack. The repetition of this procedure two weeks later resulted in another attack. The following additional two cases of respiratory sensitization to local anesthetics have since been observed.

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5. Landsteiner, K., and Van Der Scheer, J.: On the Specificity of Serological Reactions with Simple Chemical Compounds, J. Exper. Med. **54**:295 (Sept.) 1931.

6. Avery, O.; Tillett, W. S., and Goebel, W. F.: Active and Passive Anaphylaxis with Synthetic Sugar Proteins, J. Exper. Med. **50**:521 (Oct.) 1929.

7. Waldbott, G. L.: Anaphylactic Shock from Substances Other Than Pollen and Serum, to be published.

8. Waldbott, G. L.: Asthma Due to a Local Anesthetic, J. A. M. A. **99**:1942 (Dec. 3) 1932.

REPORT OF CASES

CASE 2.—Mr. N. W., aged 34, with severe chronic vasomotor rhinitis, who was found sensitive to various foods and pollens, and particularly to house dust, was given a nasal application of procaine hydrochloride to the membranes of both nostrils by a rhinologist. Within a few seconds a very severe swelling of the nasal mucosa and of the conjunctivae, cough and considerable wheezing in the chest occurred which lasted for twelve hours. Temporary control was obtained by ephedrine. On account of the severity of the symptoms, it was not regarded safe to repeat the application of the anesthetic for demonstrative purposes.

Scratch tests for procaine hydrochloride and cocaine powder were negative. However, a patch test showed within twenty-four hours a definite positive reaction to procaine hydrochloride and a negative one to cocaine.

CASE 3.—Dr. I. G., a dentist, aged 46, with pollen hay fever, noted frequent "hay fever" symptoms at times other than the hay fever season, especially while working in his office. On his being advised of the possibility of cocaine sensitization, he was able definitely to trace his symptoms to this source. While in my office a small amount of cocaine powder was blown into the air, which resulted in no untoward symptoms. On repeating this procedure with procaine powder, severe paroxysmal sneezing occurred immediately followed by rhinorrhea and conjunctivitis. Skin tests, transfer tests and patch tests were negative.

As far as I can determine there is only one reference in the literature to ether sensitization: Duke[9] reported the case of a youth in whom exposure to ether fumes elicited coryza, cough, asthma and conjunctivitis. The following two cases were observed.

CASE 4.—Miss W. M., aged 24, with allergic rhinitis, and sensitive to certain foods, chicken feathers and other inhalants, stated that the smell of ether invariably evoked severe sneezing. This was easily verified by opening a bottle of ether in her presence. Within a few seconds a marked swelling of the mucous membranes associated with conjunctivitis occurred, accompanied by a dry hacking cough. The symptoms began to recede within fifteen minutes and disappeared completely within three hours. The following day the patient was subjected to exposure to the fumes of chloroform, ammonia, turpentine and acetic acid, two of which produced the nasal irritation usually seen but not characteristic of allergy. The cough and sneezing were again elicited by the inhalation of ether. A drop of ether applied to the skin produced a marked erythema, more intense than that resulting from a control test with chloroform, but no pseudopods appeared. On transferring the patient's blood into a normal person within twenty-four hours before an ether anesthetic was administered and on observation of this area during the anesthesia, no wheal was produced. A negative outcome of the passive transfer test is, as stated before, not unusual in the presence of definite allergy to the drug.

CASE 5.—Miss B. P., aged 37, with severe asthma, and sensitive to various substances, made the statement that while she lived in the hospital in which her father was superintendent wheezing and dyspnea invariably developed when she passed by the operating room where ether was being administered. On exposing her to an open bottle of ether an attack of asthma, wheezing and cough resulted which lasted thirty minutes and then subsided. The other inhalants, including chloroform, for which she was thus tested, failed to produce this effect. Passive transfer was not attempted.

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9. Duke, W. W.: A Type of Drug Allergy Caused by Contact Sensitiveness to Ether and Chlorine, J. Allergy **3**:495 (July) 1932.

According to the previous studies on human anaphylaxis with pollen, serum and other antigens, it appears likely that more serious complications, probably in the form of anaphylactic death, would have arisen if an ether anesthetic had been administered to the ether sensitive patients, or if the procaine and cocaine, respectively, had been given subcutaneously, particularly if by accident a blood vessel had been struck and the material thus introduced intravenously.

Among the twelve cases of so-called thymic death [2] that came to autopsy, four occurred during operation with ether anesthesia. In two of these (tonsillectomies) there was an allergic history. Death occurred before the operative procedures had been started. The autopsies revealed the typical thymico-suprarenal syndrome, consisting of hyperplasia of lymphoid tissue, capillary dilatation and edema of the lungs (anaphylactic ?), petechial hemorrhages and certain changes of the epinephrine-producing part of the suprarenals.

One patient in my series of collected cases of anaphylactic shock [7] following the administration of drugs died immediately after the injection of a therapeutic dose of procaine hydrochloride, which was administered by his physician for the purpose of instituting a pneumothorax.[10] Because in this instance both lungs showed an advanced degree of pulmonary tuberculosis, the autopsy observations were not clear and were of no value for the purpose of demonstrating the typical changes of anaphylactic shock.

It is not my purpose in this paper to go into further details on human anaphylactic shock, which will be taken up elsewhere, but I shall attempt to outline briefly some of the measures for its prevention when administering anesthetics. These measures are arrived at from my previous investigations on shock following the administration of pollen, serum and other antigens.

1. All allergic patients to be operated on should be tested for the anesthetic which is to be administered. Since skin testing and passive transfer tests are known to be unreliable, a clinical test consisting of the inhalation of the general, or a previous administration of the local, anesthetic, well diluted, should be given. A conjunctival test consisting of the application of a diluted solution of the local anesthetic into the conjunctival sac may aid in the discovery of sensitization.

2. With a local anesthetic, special caution should be exercised to prevent an accidental intravenous injection. The plunger of the syringe should be retracted and the injection discontinued if blood appears in the syringe.

3. With the exception, perhaps, of the synthetic ephedrines, there is no drug known at present which prevents anaphylactic shock other than epinephrine. Such drugs should be given, as has been the custom,

10. Courtesy of Dr. J. Kasper, Herman Kiefer Hospital.

with every application of a local anthesthetic. The retardation of the absorption of the anesthetic through its vasoconstrictive action as well as the ability of epinephrine to counteract the basic lesion of anaphylaxis, namely, capillary dilatation, account for the beneficial effect of this drug in anaphylaxis. This shock-preventing ability of epinephrine may be one of the main reasons why this drug has been so widely used empirically as an adjunct to local anesthetics.

SUMMARY

1. Five cases of respiratory sensitization to local and general anesthetics are reported.

2. The bearing of this condition on the production of sudden, heretofore, unexplained death during local and general anesthesia, a study of which will be presented elsewhere, is discussed.

3. Measures for the prevention of anaphylactic shock from these substances are presented.

602 Professional Building.

DISEASE OF THE SINUSES

DIAGNOSIS AND TREATMENT BY DISPLACEMENT

JOHN R. FRAZEE, M.D.

BOSTON

The displacement method of diagnosing and treating diseases of the sinuses, as described by Dr. Proetz of St. Louis, was begun at the Massachusetts Eye and Ear Infirmary in September, 1931, at the request of Dr. Mosher and through the cooperation of Dr. Macmillan and the roentgenologic department. A total of ninety-three patients were studied. The preliminary diagnoses are given in table 1. In fifty-six cases routine roentgen examination showed a thickened lining membrane, and in sixteen there was also retained secretion or pus. Thirteen patients with atrophic rhinitis were treated, and in eight cases preliminary roentgenograms showed no pathologic condition of the sinuses.

The displacement principle, as is well known, depends on the elasticity of air contained in the sinus cavities, small portions of which can be displaced by suction applied to the nostril and replaced by droplets of any fluid in contact with the ostium when the vacuum is released. When this fluid is radiopaque it is intended to aid in diagnosis; when the fluid is a medicament it serves as a therapeutic agent. A 50 per cent solution of iodized poppy-seed oil 40 per cent in olive oil was used in thirty-one cases for diagnosis. Sixty-eight patients received 290 instillations of a medicament, usually 0.5 per cent ephedrine in physiologic solution of sodium chloride. A phenolized alkaline solution was often used to cleanse the nasal cavity, and forty-nine patients were given 138 such treatments. Of the thirty-one patients given iodized poppy-seed oil, all the sinuses showed some filling in only eleven. Of the nineteen in which the oil did not enter one or more sinuses, this fact was accounted for in six by the fact that previous roentgenograms showed pus in the sinuses. In one case the procedure was totally unsuccessful. Check-up plates made seventy-two hours after introduction of the iodized oil showed some fluid remaining in twenty cases (this is what Proetz termed delayed emptying). One patient had a severe headache following the procedure, but four patients claimed relief from symptoms.

According to Proetz, sinuses admitting no fluid should be treated surgically, whereas those showing delayed drainage are suitable for medication. But when these cases were followed this rule did not seem

to hold, except for sinuses previously known to contain pus and therefore treated surgically. In fact, in no instance has this method of diagnosis added any important finding not previously shown in routine roentgen examination of the sinuses. It has usually furnished confirmatory evidence, but further than this diagnostic attempts have

TABLE 1.—*Results of Ordinary Preliminary Diagnosis*

Cases	Diagnosis
56	Chronic sinusitis without pus
16	Chronic sinusitis with retained secretion
13	Atrophic rhinitis
8	Normal roentgenograms
93	

TABLE 2.—*Introduction of Fluid*

For diagnosis		Cases
Iodized poppy-seed oil introduced		31
For treatment	**Cases**	**Treatments**
Medicament introduced	68	290
Nasal cavity irrigated	49	138

TABLE 3.—*Diagnosis When Iodized Poppy-Seed Oil Was Introduced*

	Cases
All sinuses filled	11
All sinuses not filled (6 contained pus)	19
No sinuses filled	1
Emptying delayed	20
Reactions	
Headache	1
Favorable	4

TABLE 4.—*Results When Medicament Was Introduced*

	Cases	Per Cent	
Improvement slight	12	18	63
Improvement marked	31	45	
No improvement	7	10	37
Reactions	5	7	
Effect undetermined	13	20	
Total	68		

proved disappointing. The application of the displacement method to treatment appears more encouraging. Sixty-three per cent of these sixty-eight patients were improved; that is, their headaches and nasal discharge diminished, and they could breathe more easily and felt better generally. "Slight improvement" means relief for three or four days following the introduction of ephedrine. "Marked improvement" means that some or all of the symptoms were relieved for a longer period than the local medication could be expected to have an effect. Seven per cent complained of increase of symptoms, usually headache. In

20 per cent the records were incomplete or the patient did not continue the treatments (usually he had had only one treatment). In these cases the treatment has been considered as a failure, however. Headache was the commonest chief complaint, and of fifty-two patients the symptom disappeared or diminished in 66 per cent. In seven patients headache was unrelieved or worse, and in ten cases no effect was recorded. Of the seven patients, three came to operation, three were of a neurotic type with negative findings on roentgen examination and on the injection of iodized poppy-seed oil, and one was improved when the medical department prescribed liquid petrolatum by mouth.

TABLE 5.—*Effect on Headache (52 Cases)*

	Cases	
Symptom disappeared	21	66%
Symptom diminished	14	
Symptom persisted or increased	7	34%
Undetermined	10	

TABLE 6.—*Effect on Atrophic Rhinitis*

	Cases
Marked improvement	5
Slight improvement	1
No improvement	2
Undetermined	5
Total	13

The nasal cavity is readily cleansed by the introduction of a warm alkaline solution into one nostril while the nasopharynx is kept closed and the fluid removed from the other nostril by negative pressure. By such means, together with instillations of oil and glycerin into the sinuses, patients with atrophic rhinitis were given a series of eight or more treatments in addition to routine cleansing and medication at home. Six patients found considerable relief, crusts disappearing, ozena diminishing and the nose becoming more comfortable. The five in which the effect was "undetermined" had but one treatment each.

In conclusion, the displacement method has usually confirmed but has never added to the results of routine roentgen examination of the sinuses in these cases. When the method has been used as a therapeutic procedure however, a majority of patients have been relieved, at least temporarily. Displacement is an adjunct more effective than sprays and nasal packs, but perhaps less effective than it is sometimes claimed to be.

243 Charles Street.

Clinical Notes

ASTHMA IN RELATION TO NASAL SINUSITIS

LEE M. HURD, M.D., NEW YORK

The syndrome of bronchial asthma has been thoroughly discussed as to its mechanism and causes from all angles by so many competent men that I wish only to emphasize the fact that among the probable causes one is the nasal sinus, in which the patient is sensitized to his own organisms. Tests on the skin with these organisms give a marked positive reaction, but the patient will not react to similar organisms from some other person.

That there is too much nasal surgical intervention of a kind performed on patients with asthma is well known. These operations are not always successful because the patient is not sensitized to his own sinus organisms, or because the operative work is not thorough enough.

These cases are rare, but brilliant results follow relief of the sinus infection by operation.

The sinuses most often affected are the ethmoids, sphenoids and antrums, rarely the frontals.

The suspension I use for intradermal tests is made as follows: Organisms are grown as for vaccines, that is, different mediums for different organisms. For example, plain agar is used for staphylococcus, serum or ascitic fluid agar for streptococcus, and so on. Suspensions are made by washing off the growth with sterile saline, and then standardizing at 1,000,000,000 per cubic centimeter. The organisms are killed by heating for one hour between 60 and 70 C., and then cultured for forty-eight hours for sterility. If not sterile, they are heated and cultured again. No preservative is added.

I have seen ten cases of asthma caused by sinus infection, three of which I shall report in detail. In all the cases, the sinusitis was extremely extensive, of the polypoid type, which required surgical treatment regardless of the asthma.

REPORT OF CASES

CASE 1.—*History.*—J. G., a man, aged 38, was seen on May 31, 1930. He had had a cold one year previous to my examination, followed by asthma. He had had a hundred tests on the skin which gave negative results except for cottonseed, 2 plus, and horse serum, 2 plus. Treatments with vaccine had failed to give relief. When the patient first came to me he was sneezing, and had an increased nasal discharge and severe asthma.

Examination.—The nasal mucous membrane was red; there were considerable mucopus and polypoid degeneration of the ethmoids and the middle turbinates. On transillumination, the right antrum was dim, and the left, dark; the right frontal sinus was clear, and the left, slightly dim. Mucopus was present in the pharynx, and there were tracheal congestion and a slight interarytenoid thickening.

Read before the Eastern Section of the American Laryngological, Rhinological and Otological Society, Boston, Jan. 6, 1933.

Roentgenograms of the sinuses showed the frontal to be small and cloudy; the ethmoids were cloudy, and the cellular network was almost invisible; the antrums and sphenoids were cloudy. The nasal passages were occluded by marked thickening of the intranasal tissues.

Course.—Ten months later, on March 14, 1931, the patient returned to me. He had had some polypoid tissue removed on the right side with relief from asthma for six months. For the past six days he had had continuous asthma. The mucous membrane was pale. The right side was swollen, so that it was completely closed; there was a crust on the left side. Culture suspensions contained Streptococcus haemolyticus, Staphylococcus albus and Bacillus influenzae, to which he reacted positively. He returned five weeks later, reporting continuous asthma.

A blood count showed: red cells, 4,500,000; white cells, 26,200; hemoglobin, 82 per cent. A differential count showed: polymorphonuclears, 82 per cent; lymphocytes, 14 per cent, and eosinophils, 2 per cent.

On April 30, I performed a double radical operation on all the sinuses. The frontal sinuses were small and filled with polypoid tissue; the ethmoids showed orbital extension, and the sphenoids were filled with polypoid tissue. Both antrums were filled with polyps.

The day following operation the patient had marked asthma. The histologic report on the tissue removed was as follows: "large masses of inflammatory and polypoid tissue, large amount of inflammatory exudate and portions of mucous membrane in which there is a preponderance of eosinophils in the inflammatory reaction. Glandular element well differentiated, no evidence of malignancy."

Ten days after operation, the wound had healed by primary union. There had been no diplopia at any time. The patient still had a productive cough, and had had two slight asthmatic attacks.

In May, the patient still had slight asthma at times. A vaccine made from a culture of the secretion in his nose, containing Streptococcus haemolyticus, Staphylococcus albus and Bacillus influenzae, stopped the attacks. He has been free from asthma for about two and a half years.

CASE 2.—*History.*—A. L., a man, aged 40, was seen on Feb. 18, 1929. He had had asthma for one and a half years. More than two hundred tests with protein had been made; all gave negative results except for staphylococcus. One antrum had been punctured and douched for eighty-five consecutive days. Osteopathy for a month had afforded some relief at first. When he came to me he complained of stuffiness in his nose, a new condition which was followed by asthmatic attacks of greater severity. He could not lie down, so was forced to sleep sitting up.

Examination.—The mucous membrane was pale; the posterior tips of the middle and inferior turbinates were polypoid. Transillumination showed a dark right antrum; the left was dim. Thin pus was douched out of the right antrum, and mucopus from the left. The right frontal sinus was slightly dim; the left was clear. There was polypoid degeneration of the right ethmoids, and pus was coming from the middle meati. Roentgenograms showed slight blurring of the mucoperiosteal lines of the right frontal sinus. Both ethmoids were cloudy; the cellular structure was almost invisible. The sphenoids were cloudy, and the antrums were extremely so. The patient was sensitive to Staphylococcus albus, 3 plus.

Operation and Course.—With the patient under local anesthesia, an intranasal operation was performed. The ethmoids, which had large orbital extensions and contained polypoid tissue and extremely thick mucus, were exenterated. The

sphenoids were also filled with polypoid tissue. A large window was made into each antrum; both were filled with grapelike polyps, which were removed.

The patient had a postoperative ecchymosis and swelling of the left upper lid with limitation of motion of the eye and some diplopia. This condition developed after hard blowing of the nose the day after operation.

On the seventeenth day, the patient had an attack of asthma, and on the twenty-third, he sailed for Europe. He had several slight attacks on reaching Europe, but now his nose is normal and he is free from asthma, and he rarely has colds. This state has existed over a period of three years.

CASE 3.—*History.*—E. M. S., a man, aged 48, was seen on Aug. 20, 1923. He had had repeated attacks of acute otitis superimposed on a chronic discharge from the ears. He had frequent colds, but no cough. He had hay fever with asthma from August 20 until frost. He had had two radical operations on the frontal sinuses and antrums.

Examination.—The septum was badly deviated; the nasal mucous membrane was congested, and there was mucopus everywhere. The tonsils were small, and there was no débris. There was a perforation in the attic of the right ear, and an inferior perforation in the left. There was a discharge from both ears, but there was no odor. Culture from the nose contained Streptococcus viridans and Staphylococcus albus and aureus. Intradermally, the Streptococcus viridans reaction was 3 plus; Staphylococcus albus, 6 plus, and Staphylococcus aureus, 4 plus. Roentgenograms showed heavy opaque shadows nearly filling the antral cavities. The right frontal sinus was more cloudy than the left. One-half inch (1.27 cm.) above the left frontal sinus there was a small round hole in the skull. The ethmoids and sphenoids were extremely cloudy.

Two years later, in November, the patient complained of asthma. He had had two hundred tests with protein in Chicago, all of which gave negative results. I referred him for a general survey. High colonic irrigation brought on asthmatic attacks, and he refused to finish the survey.

Operation and Course.—The ethmoids were filled with polypoid tissue, which was removed. The asthma continued. One and a half years later I did an external operation on all the sinuses. The frontal sinus on the left side, which was small, had apparently never been entered. There was a hole through the frontal bone about a fourth of an inch (0.64 cm.) in diameter above the frontal sinus, as though a trephine had been used, which was filled with fibrous tissue attached to the dura. The right frontal sinus was closed off from the nasal cavity and filled with pus under considerable pressure. The ethmoidal labyrinths were narrow, a number of small cells remaining, all filled with pus under pressure. The sphenoids were also filled with polypoid tissue. Eight days later both antrums were opened under local anesthesia, a Caldwell-Luc operation being performed. Four days later the patient was discharged from the hospital. He was sleeping twelve hours every night, and was free from asthma.

Four months later there was a recurrence of the discharge from the ears. I gave him an ampule of a colloidal calcium preparation, which was followed by an attack of asthma. Two months later he reported that he had almost no asthma. Three years later he experienced occasional slight attacks of asthma.

Six years later the patient was again examined, when he said that he had had some asthma until one year previously; at that time his tonsils were removed in Los Angeles. Since then he had been entirely free from asthma, with the exception of three days immediately following the tonsillectomy.

I had never found any débris in his tonsils, and several other men had said that his tonsils were normal.

This is a case in which the sinuses were the main factor, but unsuspected tonsils were the final factor.

39 East Fiftieth Street.

EXOSTOSIS OF THE EXTERNAL AUDITORY CANAL

Removal with the Electric Burr

ALFRED A. SCHWARTZ, M.D., NEW YORK

A. G. was first seen by me in October, 1926, when he was 10 years of age. He had been referred for tonsillectomy, because of an attack of tonsillitis four months previously, which had been followed by an acute rheumatic attack and endocarditis. As long as he could remember, the left ear had felt "clogged," especially on arising in the morning.

Examination showed, in addition to badly diseased tonsils, a firm growth in the left external auditory canal, which was not bony in consistency. The diagnosis of a cartilaginous growth was made. This was about the size of a pea, and occluded about three quarters of the external canal. It arose from the postero-inferior part of the external canal.

The tonsils were removed on October 30, and at the same time the growth in the external canal was removed. This was done easily with a curet. It proved to be an osteochondroma.

The patient was seen several times during the next two months. The external canal healed perfectly, and hearing was normal. He was not seen again until Aug. 5, 1932. For three years previously, he had complained of difficulty in hearing in the left ear. Examination showed a mass, completely filling the external canal at the meatus and extending far inward toward the drum. A fine probe could be passed above it with difficulty. The mass was bony in consistency, and the diagnosis of exostosis was made. It arose from the postero-inferior portion of the canal. Because of the size of the growth, which was already pressing on the anterior wall of the canal, and the marked deafness, operation was advised. This was performed on August 9, with the patient under general anesthesia, at the Beth Israel Hospital.

It was decided to use the electric drill to remove the mass. Since a record of this procedure could not be found, the patient was prepared for mastoidectomy in case of failure, for it was thought best not to risk the use of the chisel through the external canal.

A small amount of epinephrine hydrochloride solution was injected into the skin about the growth to prevent bleeding. The skin covering the mass was very thin and could not be separated from the bone. An incision was then made at the junction of the exostosis and normal canal wall, and the bony mass was exposed. The point of a fine burr was placed near the attached sessile border of the mass. The drill was directed upward and forward, away from the base and from the line of the posterior wall of the canal. The upper half of the exostosis was quickly loosened and removed; then, with a larger burr, the remainder of the mass was leveled. It was found that the tumor reached within one-eighth inch of the drum,

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From the Otological Department, Beth Israel Hospital.

but the drum was never in danger from the drill. The external canal was widened to slightly more than normal, and a sterile dressing was inserted.

Convalescence was uneventful. There was a serosanguineous discharge from the external canal which lasted three weeks, gradually diminishing. The external auditory meatus and the external canal are both slightly more roomy on the operated than on the normal side. The drum is intact, and hearing is normal. There is a small amount of scar tissue present on the postero-inferior wall of the canal.

COMMENT

Exostoses of the external auditory canal are not uncommon. In the vast majority of cases these cause no symptoms and are discovered during a routine examination. As a rule, deafness is the only complaint. If the growth causes pressure, there may be pain. It is well recognized that only those exostoses which cause symptoms should be removed.

There are two types of exostoses, the pendunculated and the sessile. The pedunculated type is easily removed. The base can be broken without danger, with a curet, and the mass separates entirely.

The sessile type, however, presents a more serious problem, and several operative procedures have been devised for the relief of this condition. The simplest is the use of the chisel, the growth being removed through the external canal. This is manifestly dangerous, for one cannot predict which way the bone will break, or how far. The danger to the facial nerve must also be considered.

The usual operative procedure is a postauricular incision, separation of the skin from the bony posterior wall of the canal as far as possible, and removal of the exostosis by means of the chisel. Page has recommended the modified radical operation on the mastoid, with its leveling of the posterior wall of the canal, and for growths which invade the mastoid process, this operation seems the most logical and the safest.

These operative procedures appear extensive for so simple a condition as an exostosis. The electrically driven burr has been used safely and satisfactorily in removing spurs from the nasal septum (Hurd). It was thought feasible to try this same method, a pointed burr being used on the exostosis of the external auditory canal.

It must, of course, be remembered that many of the large sessile exostoses extend far inward toward, or even to, the drum. This is no contraindication to the use of the drill, for the direction and force of the drill is always under complete control, and the operative field is easily and continuously viewed through a large speculum. Unless the surgeon wishes it, there is no breaking of bone, and after the uppermost portion of the exostosis has been carefully leveled, larger burrs are used for the base of the growth.

No effort is made to save the skin over the exostosis. This is thin and tears easily. However, an incision should be made at the margin of the growth, and the skin and periosteum of the normal canal separated for a short distance to avoid trauma by the burr. A preliminary injection of a weak solution of epinephrine hydrochloride is most helpful in preventing bleeding.

COMMENT

The foregoing case is reported because of the development of an exostosis on a previously existing cartilaginous growth, which had been removed six years before.

The use of the electric drill proved simple, and the entire mass was removed without a postauricular incision or mastoidectomy.

7 West Seventy-First Street.

NASAL SUTURE NEEDLE

JULIAN Y. MALONE, M.D., MILWAUKEE

The suture needle illustrated is of service in any type of intranasal plastic operation. All other nasal suture needles which I have tried are more bulky and require more space in which to manipulate them. It has been suggested that there are situations in general surgical work in which this needle would be of advantage.

I have used this instrument since 1928 whenever it was necessary to suture within the nose, and it has served me admirably in all the situations encountered.

The difficulty of tearing a friable mucous membrane that is encountered with other suturing instruments is overcome entirely with this needle. The depth of the bite taken may be varied at will, the suture being put through one side of the incision at a time.

Fig. 1.—*A* indicates the movable guard, and *B*, the lancet-shaped thin blade. *C* shows the eye of the needle closed.

Fig. 2.—View of the instrument showing the V-shaped thread holder.

DESCRIPTION

The needle consists of a lancet-shaped thin blade (fig. 1 *B*) which passes easily through the tissue and a movable guard (fig. 1 *A*) which opens or closes the eye. When the lancet part is pushed through the tissue, the guard is opened and lies back against the shank of the instrument. The suture material is then placed in the hooked portion of the eye with the V-shaped thread holder (fig. 2); the needle is withdrawn, and as it comes back through the mucous membrane the guard is forced back into position against the lancet, thus closing the eye of the needle (fig. 1 *C*). The same procedure is repeated through the other side of the incision.

All parts of the needle are so constructed that there are no sharp points to catch in the tissue, and as the instrument is made of stainless steel, there is no fear of the guard becoming unworkable on account of accumulation of rust.

The shank is bent at an angle near the eye so that the operator's hand does not interfere with his vision, and on account of this bend in the shank the instrument can be used both on the right and on the left side. When the needle is used on one side the guard opens upward, and when used on the other side it opens downward, but this does not inconvenience the operator.

The instrument has been made for me by V. Mueller & Co. of Chicago.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

TUMORS OF THE NOSE AND THROAT

GORDON B. NEW, M.D.

AND

WALTER A. KIRCH, M.D.

Fellow in Otolaryngology, the Mayo Foundation

ROCHESTER, MINN.

GENERAL CONSIDERATIONS

Englmann [1] found that doses of roentgen rays or radium which were lethal for the tumor cells produced a marked reaction in the surrounding tissues. He considered the radiosensitivity of various types of tumors and the effects of irradiation on healthy tissues. He found that with the protracted fractional method far greater doses of radium or roentgen rays can be used without permanent injury to the normal tissues than with the old method of single doses, because the tissues maintained their regenerative powers.

Richter [2] reported 115 cases encountered between 1919 and 1926. Twenty-two of the patients (19 per cent) had been well for five years or more at the time of the study. Eighty-five of the tumors were carcinomas and 25 were sarcomas. For operable conditions Richter advised a surgical procedure followed by irradiation, particularly in cases of carcinoma. Sarcoma is more susceptible to treatment by irradiation. For endonasal and antral tumors he employed Denker's permaxillary operation, and for the last two years before his report he had used Coutard's irradiation technic. He did not give his results, for the time that had elapsed since treatment was too short. He stated that operation should be urged for all operable lesions.

From the Section on Laryngology and Oral and Plastic Surgery, the Mayo Clinic.

1. Englmann, K.: Strahlentherapie in der Oto- Rhino- Laryngologie (morphologischebiologischer Teil), Ztschr. f. Hals-, Nasen- u. Ohrenh. **31**:87, 1932.

2. Richter, H.: Zur Klinik, pathologischen Anatomie und Therapie der bösartigen Geschwülste des Ohres, der oberen Luft- und Speisewege, Ztschr. f. Hals-, Nasen- u. Ohrenh. **31**:169, 1932.

Lüscher [3] reported 255 cases of tumor of the nose and throat seen in the Bern Clinic between 1924 and 1929. Twenty-seven of the tumors were in the sinuses, 16 in the tonsils and 20 in the pharynx. Seventy-six tumors were extrinsic to the larynx, 17 were intrinsic to the larynx and 68 were in the esophagus. At the time of Lüscher's survey, 10 patients had been well five or more years, 10 from three to five years and 9 less than three years. Lüscher advised a combination of surgical measures and irradiation, for he felt that the addition of irradiation improved the patient's chance twofold or threefold. He advised attempting operative measures even in hopeless cases, for there is an occasional chance of saving, or at least of prolonging, life. He admitted that permanent cure is possible by irradiation alone, and that it is not necessary to use large amounts of radium. The average amount used in his cases was 100 mg.

Hesse [4] reported 137 cases. In most of these surgery, or surgery combined with irradiation, was employed. The best results were obtained in external nasal carcinomas of low grade; 26 endonasal and sinus carcinomas were operated on, and in 8 of these (31 per cent) cures resulted. Hesse did not state the time which had elapsed after operation. He claimed good results, both by Denker's operation and by resection of the maxilla combined with irradiation. Sarcoma is more susceptible to irradiation than carcinoma. In 42 cases of carcinoma of the larynx, he obtained good results from operation in those in which the carcinoma was intrinsic. Three patients were operated on under suspension laryngoscopy. Of the 18 with extrinsic carcinoma of the larynx, 4 remained well for over four years. Hesse's proportion of cures in cases of extrinsic carcinoma was 33 per cent; in cases of intrinsic carcinoma, 60 per cent, and in the early cases, in which the carcinomatous involvement was limited to one vocal cord, 100 per cent. In carcinoma of the esophagus he obtained some good results by using radium and roentgen rays, and by using diathermy administered through an esophagoscope. Of 22 patients, 1 remained well for two years and 1 for a year and a half. Hesse expressed the belief that he had not had sufficient experience with irradiation according to Coutard's technic to decide as to its value.

Coutard [5] reported the results with epitheliomas of the tonsillar, hypopharyngeal and laryngeal regions, treated between 1920 and 1926.

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3. Lüscher, E.: Die Erfahrungen der Berner-Klinik mit Radiumbehandlung, insbesondere der Radiumpunktur bei Schleimhautkrebs der oberen Luft- und Speisewege, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:193, 1932.

4. Hesse: Zur Behandlung maligner Tumoren des Hals-, Nasen- Ohrengebietes, Ztschr. f. Hals-, Nasen- u. Ohrenh. **31**:233, 1932.

5. Coutard, H.: Roentgenthérapie des épithéliomes de la région amygdalienne, de l'hypopharynx et du larynx au cours des années 1920 à 1926, Radiophys. et radiothérapie **2**:541, 1932.

In 46 cases the tonsillar region was involved, in 89 cases the hypopharynx and in 77 cases the larynx. All the patients were treated with roentgen rays. One hundred and fifty-seven (74 per cent) died within two years. In 55 cases (26 per cent) the primary lesion disappeared. In 12 of the cases of tonsillar involvement, in 18 of those of hypopharyngeal involvement, and in 25 of those of laryngeal involvement the local lesion disappeared. Thirteen of 89 patients with hypopharyngeal epitheliomas were well for three years. None was well for as long as nine years. The percentage of cures in cases of carcinoma of the tonsil and larynx remained constant from two to nine years. The proportion of men to women was 13:1. Coutard described and considered in detail his protracted fractional method of treatment. The object of the treatment is to give sufficient dosage to destroy the germinal cells of the epidermis without destroying the dermis, and this entails marked reaction of the skin and mucosa. Coutard described the various complications which follow this energetic treatment, that is, edema, hemorrhage, erythema, adenitis, perichondritis, changes in the sense of taste, dryness of the mouth and various types of atrophy caused by roentgen rays. Illustrations of the extreme reaction following this treatment accompany the report.

Harmer [6] considered the value of roentgenotherapy for carcinoma of the upper air passages. He advised the close cooperation of surgeon, pathologist, physicist and roentgenologist in the treatment. Comparing roentgenotherapy with surgery, he found that if the lesions are divided into operable, borderline and inoperable, the first type gives about equal results with operation and with irradiation, whereas for inoperable lesions radiation is far superior; on the whole, irradiation is to be preferred to surgical measures. Harmer advised treatment by prolonged small doses with strong filtration, and expressed his preference for needles rather than radon seeds. He expressed the belief that the poor results obtained in the radium treatment of lesions of the larynx are the result of faulty technic. In operable conditions he has had as good results from radium as from surgical measures. The preferred method, with radium therapy, is direct implantation in the growth. For treatment in the larynx he used Ledoux's or Hautard's window methods, according to the extent of the lesion. If the radium does not cure the carcinoma, he wrote, its use should not be repeated, but laryngectomy should be resorted to. For growths in the nose Harmer found radium preferable, except for radium-resistant tumors, for which he used diathermy. The most common type of tumor found in the sinuses is adenocarcinoma, which has a rather benign course. The best results are

6. Harmer, Douglas: The Relative Value of Radiotherapy in the Treatment of Cancers of the Upper Air Passages, Brit. M. J. 2:910 (Nov. 14) 1931.

obtained by combined surgical measures, diathermy and irradiation. Harmer advised preliminary treatment by roentgen rays before biopsy, in order to diminish the possibility of spreading the disease. His expressed preference was for the transpalatal approach to tumors of the antrum because of the relatively small deformity that it entails. The gross part of the tumor was removed by diathermy, and then radium was used in heavy doses. He treated sarcoma of the nasal sinuses differently, according to its histologic type. Myeloid or fibrous sarcomas were treated surgically; chondrosarcoma, osteosarcoma or myxosarcoma, by the combined method. Round cell and spindle cell sarcoma he found extremely susceptible to irradiation. Results with nasopharyngeal growths, in his opinion, are poor. More carcinomas than sarcomas of the nasopharynx are cured; of the latter few are cured. Harmer advised prolonged irradiation, with a small dose and heavy filtration. A severe reaction and necrosis frequently follow, but this result cannot be avoided. For growths of the tonsil and mesopharynx, surgical measures are dangerous. Harmer expressed his preference for irradiation and then removal of the tumor rest with diathermy. He treated 53 patients with tumors of the sinuses, of whom 10 were living at the time of writing; 16 patients with nasopharyngeal tumors, of whom 6 were free from disease, and 64 patients with tonsillar tumors, of whom 5 lived for one year. He concluded that in the future treatment of growths in these regions would tend to be more and more in the hands of highly specialized and accomplished clinicians.

Colledge and Peacock [7] reported 126 cases of malignant disease of the upper air passages in which treatment was given between 1921 and 1930. In 108 of the cases, the larynx or hypopharynx was involved; in 8, the mesopharynx, and in 8, the antrum. Specimens for biopsy were obtained in all but 5 of the cases, and in all but 4 the growth proved to be squamous cell epithelioma. There was a sarcoma in the larynx of a woman aged 22; an endothelioma, a sarcoma of the tonsil and a basal cell epithelioma of the epiglottis were also noted. There were 60 intrinsic epitheliomas of the larynx. Of 48 extrinsic hypopharyngeal epitheliomas involving the pyriform sinuses, the epiglottis, the aryepiglottic fold and the postcricoid region, 23 were operable and 25 inoperable. For intrinsic laryngeal epitheliomas, total laryngectomy was performed in 42 cases, thyrotomy in 11 and partial laryngectomy in 3. The deaths resulting from total laryngectomy numbered 9, and there was 1 death in each of the other groups. The growths recurred in 12 cases following total laryngectomy, and in 2 cases

7. Colledge, Lionel, and Peacock, Roydon: An Analysis of 126 Cases of Malignant Diseases of the Upper Air Passages Treated During a Period of Ten Years, J. Laryng. & Otol. **47**:161 (March) 1932.

following laryngofissure, but did not recur following partial laryngectomy. One patient lived for ten and a half years following total laryngectomy, another for eight and a half years following thyrotomy, and another, at the time of Colledge and Peacock's study, had lived two years following partial laryngectomy. Recurrences appeared in an average of nine months following total laryngectomy. In 1 case recurrence was delayed eight and a half years. For extralaryngeal growths pharyngotomy was performed in 12 cases, with 5 deaths; pharyngolaryngectomy in 9 cases, with 3 deaths; subhyoid pharyngotomy in 1 case, in which death occurred, and median translingual pharyngotomy in 1 case. In the cases in which lateral pharyngotomy was performed there were 3 recurrences, and in those in which pharyngolaryngectomy was performed, there were also 3 recurrences. The sites involved were: the pyriform sinuses, 3 cases; the epiglottis, 6 cases; the aryepiglottic fold, 8 cases, and the postcricoid region, 4 cases. The longest period of survival without recurrence was three years. Recurrences took place in from ten months to two and a half years. Among the 8 cases of nasopharyngeal tumor there were no operative deaths, and no patients lived longer than two years. In 1 of the 8 cases of antral growths the patient was treated with a huge dose of radium (10,100 mg. hours), and was living after ten months. One patient lived four years. Eight patients, 3 with laryngeal, 4 with antral and 1 with tonsillar epithelioma, were treated principally with radium. The patient with tonsillar involvement had been well for three years at the time of the study. A noteworthy fact brought out by the author is the difference in the mortality rate between patients undergoing laryngectomy who are treated in the hospital and those treated privately. Among the former the rate is 40 per cent; among the latter, 4.5 per cent. The author explained the discrepancy between these two classes as being due to the poor general condition of the patients treated in the hospital and the fact that their postoperative care is in the hands of a frequently changing staff. The difference appears in other groups of cases, as well as in those in which laryngectomy is performed. The first 4 patients who underwent lateral pharyngectomy, and whose pharynges were closed primarily, died of bronchopneumonia. When, in later cases, the pharyngeal mucosa was sutured to the skin about a pharyngeal stoma, the mortality rate dropped markedly. Bronchopneumonia was a predominant cause of death. The authors concurred with the view that in treating tumors of the larynx and hypopharynx, an operation is to be preferred to irradiation. In treating tumors of the upper jaw and nasopharynx, the best results, the authors stated, follow irradiation. Colledge and Peacock found that previous laryngofissure was not a contraindication to subsequent total laryngectomy, and that the presence of

metastatic nodules should not be considered as an absolute contraindication to operation. Eighty per cent of the patients who underwent laryngofissure remained free from recurrence, and results were extremely promising even among patients with extrinsic and hypopharyngeal carcinoma (34.7 per cent were well). The proportion of men to women who had intrinsic laryngeal tumors was 9½ : 1; of those who had hypopharyngeal tumors, 6 : 1. (Three of the patients who died following lateral pharyngotomy had carcinoma of the epiglottis. This type of tumor often can be successfully treated by electrocoagulation under suspension.)

NOSE

Orosco and Quiroga [8] reported a case of mixed tumor of the middle concha which was removed by lateral rhinotomy. On reviewing the literature they found this tumor to be of extremely rare occurrence. The photomicrograph presented suggests an adenocarcinoma of mixed type.

Stevenson [9] reported a mixed tumor of parotid type in the septum of a girl, aged 14 years. The photomicrographs presented suggest an epithelioma rather than a mixed tumor.

ANTRUM

Michel [10] thoroughly reviewed the literature on tumors of the maxillary sinuses, and concurred in the opinion that these tumors, variously designated as cylindromas, endotheliomas, carcinomas and sarcomas, are frequently mixed tumors of the parotid type. He suggested that the tumors of the antrum and ethmoid sinuses, hitherto called cylindromas, have their origin in a persistent lateral nasal gland, or Steno's gland, which is found in the lateral wall of the nose of dogs and other mammals, but which has disappeared in primates. He drew a parallel between this origin and that of mixed tumors of the parotid gland. One case was presented, and the general clinical character of these tumors was considered.

Levesque and Gauducheau [11] presented 6 cases of tumor of the ethmoid, 6 of tumor of the upper jaw and 6 of tumor of the nasal

8. Orosco, G., and Quiroga, A.: Voluminoso tumor mixto del cornete medio de la nariz, Semana méd. **1**:1598 (May 26) 1932.

9. Stevenson, H. N.: Mixed Tumor of the Nasal Septum, Ann. Otol., Rhin. & Laryng. **41**:563 (June) 1932.

10. Michel, K. H.: Zur Kenntnis der Nasenhöhlengeschwülste, Frankfurt. Ztschr. f. Path. **43**:354, 1932.

11. Levesque and Gauducheau, R.: Traitement radiochirurgical des tumeurs du massif maxillo-facial, Bull. Assoc. franç. p. l'étude du cancer **20**:669 (Dec.) 1931.

fossa, including both epitheliomas and sarcomas. At the time of writing, the 18 patients had survived from one and a half to nine years. The authors found that a combination of surgical measures and radium gave the best results in these cases.

Sharp [12] took up the problem of carcinoma of the maxillary sinus. In the treatment of this type of malignant growth, operation alone has proved unsatisfactory, and it entails a high death rate. Electrocoagulation has been found more satisfactory. At Memorial Hospital, a special technic of irradiation has been developed; operation is employed only to provide exposure and drainage. The technic has been further improved, since it has been possible to measure exactly the dose of irradiation given to the region. Sharp considered the symptoms of the condition. The diagnosis is usually made late, he stated, owing to the lack of subjective symptoms in the early stages of the condition. Secondary infection often masks the pathologic process. Biopsy is the only sure method of making a diagnosis. The author advocated biopsy by means of aspiration through a needle, according to Martin and Ellis' technic, and suggested that this be used as a routine in all cases of disease of the antrum. According to Ewing, five types of carcinoma are found in the antrum: adenocarcinoma, schneiderian carcinoma, squamous cell carcinoma, basal cell carcinoma and transitional cell carcinoma. He stated that he considered infection as playing an important part in the etiology of this disease. Treatment at the Memorial Hospital consists of exposing the tumor, usually through the anterior antral wall, and implanting a carefully calculated dose of radon seeds. Three or four days later the floor of the antrum is removed with the palate, and complete exposure and drainage are attained. At this time the bulk of the tumor can be removed by cautery and curet. It is inadvisable to repeat irradiation. Details of the technic and of the treatment of the lymphatic structures were given, and 6 complete reports of cases illustrating various factors of the treatment were included.

NASOPHARYNX

Hansel [13] reported 9 cases of malignant tumor of the nasopharynx with involvement of the cranial nerves. He reviewed the literature, and found that the most frequently involved nerve is the sixth, and the second most frequently involved nerve, the fifth. The pain caused by involvement of the latter nerve differs from that of tic douloureux. Hansel described the various syndromes caused by involvement of

12. Sharp, G. S.: Carcinoma of the Maxillary Antrum, Radiology **17**:984 (Nov.) 1931.

13. Hansel, F. K.: Malignant Tumors of the Nasopharynx with Involvement of the Nervous System, Ann. Otol., Rhin. & Laryng. **47**:74 (March) 1932.

different cranial nerves and nerve groups and those caused by invasion of adjacent regions, and briefly described the pathologic changes. Early diagnosis is often difficult because of lack of symptoms attributable to the nasopharynx. In all cases in which there is obscure pain in the eye or side of the head or toothache, deafness, tinnitus and similar symptoms, diplopia, blindness or proptosis, paresthesia, enlarged cervical lymph nodes, dysphagia, aphonia, hoarseness and the probability of distant metastasis, with no demonstrable primary lesion, careful nasopharyngeal examination should be carried out.

Beck and Guttman [14] described malignant diseases of the nasopharynx and upper respiratory passages. They briefly described various surgical technics, as well as electrocoagulation and the various forms of irradiation. Treatment varies with the histologic changes in the tumor. The highly anaplastic, cellular structures are more susceptible to irradiation; the more differentiated and benign, to operation. The authors expressed the belief that treatment by roentgen rays will not supersede treatment by radium, for the voltage necessary to arrive at the same effects is so tremendous that it entails extremely expensive apparatus. They presented a list of 579 cases of both benign and malignant tumors. Among these there were 180 epitheliomas and 212 sarcomas. No details were given.

PHARYNX

Trotter [15] considered the problem of operation on the pharynx for malignant conditions. For the present, surgery is of wide application, but as the technic of, and experience with, irradiation improve, irradiation will gradually supersede operation. However, operation will always give desirable results in the treatment of small, early lesions. The principal requisites of successful surgical intervention for lesions in the pharynx are accurate anatomic knowledge, absence of infection and accurate knowledge of the pathologic changes involved. Trotter has found that the best approach to a growth in the hypopharynx is by transthyroid pharyngotomy. The characteristic steps of this procedure are: (1) dissection of lymph nodes and isolation of the dissected portion from the pharynx by suturing the sternocleidomastoid muscle to the prevertebral fascia; (2) removal of a section of the thyroid cartilage and the great cornu of the hyoid bone to make possible palpation of the growth through the thin wall of the pharynx; (3) primary closure of the opening in the pharynx where small growths have been removed,

14. Beck, J. C., and Guttman, M. R.: Malignant Diseases of the Nose and Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **41**:1 (March) 1932.

15. Trotter, W.: Some Principles in Surgery of the Pharynx, Lancet **2**:833 (Oct. 7) 1931.

and (4) a combination with immediate plastic procedures to cover denuded portions if the growth is large, accompanied by suturing of the mucosa to the edge of the skin. Control of infection depends primarily on operating only on edentulous patients. The author stressed this point, and stated that it is even more important if radium rather than the knife is used. He deprecated the fact that laryngectomy is still made use of in cases in which growths are immediately adjacent to the larynx. The fact that this operation is technically easier does not justify its use. If the growth is found to be too large for surgical removal, radium is inserted without opening the wall of the pharynx. Trotter expressed the belief that his results justify wider use of this type of operation, and that as time goes on patients will be seen at an earlier stage of the disease.

New, Broders and Childrey [16] considered the pathologic characteristics of tumors of the nasopharynx and pharynx, and concluded that there is no adequate reason for creating the new groups of lymphoepithelioma and transitional cell epithelioma, which correspond essentially to squamous cell epithelioma graded 4. The authors reviewed 624 cases of highly malignant tumors of the nasopharynx, pharynx, hypopharynx, tonsil and base of the tongue. In all of these cases the diagnosis was proved by biopsy. Of these tumors 78 were lymphosarcomas, 267 squamous cell epitheliomas graded 4 and 279 squamous cell epitheliomas graded 3. Of the patients 82.2 per cent were males. The average age of the patients was 52.1 years. Fifteen patients had an average length of life of fourteen years after operation. In about a fourth of the cases, swelling of the cervical lymph nodes was the first symptom noted. In a third of the cases of nasopharyngeal tumor the cranial nerves were involved. In a third of the cases of hypopharyngeal tumor there was paralysis of the vocal cords. Treatment was given in 29.2 per cent of the cases. It consisted predominatingly of irradiation, supplemented in selected cases by operation, diathermy or cauterization. Although the ultimate prognosis in these cases is poor, the advantage of treatment was shown by the difference in the length of life between patients who were treated and those who were not. The length of life of those who were treated averaged thirty-four and a half months; of those who were not treated, six and eight-tenths months. The longest survival of any patient with squamous cell carcinoma graded 3 was seven years and two months. The criterion that a patient who lives five years is cured was found to be unreliable, for 6 patients who lived for eight years finally died of carcinoma.

16. New, G. B.; Broders, A. C., and Childrey, J. H.: Highly Malignant Tumors of the Pharynx and Base of the Tongue, Surg., Gynec. & Obst. **54**:164 (Feb.) 1932.

Finney, Montgomery and New [17] reported 2 cases of xanthoma multiplex associated with diabetes insipidus. In one case the characteristic lesions were present in the pharynx; in the other, they were in the mouth, pharynx, larynx and trachea. The localization of xanthomatous patches in the upper part of the respiratory tract and in the digestive tract is rarely reported, probably because rarely sought for. In the first case there had been secondary scarring over the soft palate and tonsillar pillars, which caused some dysphagia, hoarseness and sufficient dyspnea to make tracheotomy advisable. The authors reviewed the literature and discussed the condition.

HYPOPHARYNX

Von Eicken [18] distinguished two groups of malignant disease of the hypopharynx. The first group included growths of the lateral walls of the larynx, the outer surface of the epiglottis, the pharyngo-epiglottic fold and the aryepiglottic fold. The second included growths of the sinus pyriformis and the lowest portion of the hypopharynx. The growths in the second group are clinically more malignant. The author found that the only cases which offer hope in surgical treatment are those in which the growth is of the lateral wall of the hypopharynx. He reviewed Coutard's roentgenotherapy technic. The author's own method of treatment consists of exposing the growth surgically, without opening the pharynx, and then using heavy, filtered radium in large doses. He found, from a review of the literature, that irradiation offers better results than operation, with fewer complications and no deaths.

TONSIL

Duffy [19] reviewed cases of tonsillar carcinoma seen at the Memorial Hospital. Among 18,129 patients admitted between 1917 and 1929, it was found that 2.23 per cent of those who were suffering with malignant tumors had primary growths in the tonsil, whereas the tonsil was involved in 9.64 per cent of patients suffering with malignant tumors of the buccal cavity. The author deduced from this that tonsillar carcinoma is not so rare as it is usually believed to be. He expressed the belief that the cases described in the literature as instances of sarcoma have been cases of lympho-epithelioma or transitional cell

17. Finney, W. P.; Montgomery, H., and New, G. B.: Xanthoma Multiplex, J. A. M. A. **99**:1071 (Sept. 24) 1932.

18. von Eicken: Malignant Disease of the Hypopharynx, J. Laryng. & Otol. **47**:229 (April) 1932.

19. Duffy, J. J.: Carcinoma of the Tonsils; Review of 122 Histologically Proved Cases Treated 1921 to 1928, Inclusive, Surg., Gynec. & Obst. **54**:539 (March) 1932.

sarcoma, and that the only type of sarcoma affecting the tonsil is lymphosarcoma. Operation for this type of malignant growth is of no value, and carcinoma of the tonsil may be considered as primarily inoperable. One hundred and twenty-two patients with histologically proved carcinomas of the tonsil were admitted from 1921 to 1928, inclusive. Because the tumors were considered inoperable, the author classified the cases as early or advanced; in those considered early cases only one or two adjacent regions, for instance, the tonsil proper and one of the pillars, were involved, whereas in the cases considered to be advanced, two regions were involved widely, or the involvement was of three or more regions. There were 33 early cases and 88 advanced cases. The author graded the tumors on the basis of their histologic appearance in four groups: group 1, group 2, group 3 and a transitional cell group. Seventy-five and two-tenths per cent of the cases were classified as of grade 2. Treatment consisted of heavy external irradiation applied to the area of the primary growth and to the regions of lymphatic drainage, followed by implantation of radon into the primary growth. Tables were presented giving the details of the course and treatment. The cases were divided into two periods, according to the time of treatment. In the first period, from 1921 to 1924 inclusive, radon seeds in glass tubes were implanted. In the second period, from 1925 to 1928 inclusive, "gold radon seeds" were used, with improvement in results. The "glass seeds" frequently caused necrosis, sloughing and infection. These complications were greatly diminished when "gold seeds" were used. Forty-nine patients were included in the first period. Of these, 10 (20.4 per cent) survived five years. The patients were classified according to whether they presented no palpable metastasis on admission, whether they had operable metastasis (unilateral, encapsulated and of a low grade of malignancy) or whether they had inoperable metastasis. Forty of those with operable metastasis survived five years, and one of those with inoperable metastasis survived five years. The results in the second group were not given, for the five year period had not passed at the time the material for the paper was compiled.

New and Childrey [20] reported 357 cases of tumor of the tonsil and pharynx. They divided them as follows: benign tumor, 63 cases; adenocarcinoma of mixed type, 74 cases; malignant tumor, exclusive of the adenocarcinoma of mixed type, 220 cases. The benign tumors included papillomas, adenomas, lipomas, fibromas, myxomas, angiomas, chondromas, osteomas, polyps, teratomas, cysts and lymphoid tissue

20. New, G. B., and Childrey, J. H.: Tumors of the Tonsils and Pharynx (357 Cases): I. Benign Tumors (63 Cases), Arch. Otolaryng. **14**:596 (Nov.) 1931.

tumors. Adenocarcinomas of mixed type were placed in a group by themselves, and were not considered with either the benign or the malignant tumors. Thirty-five (55.5 per cent) of the benign tumors were papillomas. Most of the 74 patients with adenocarcinomas of mixed type were males. Patients with adenocarcinoma present hard masses, usually laterally in the pharynx, which may cause the palate to bulge and may extend into the submaxillary or parotid regions. New and Childrey recommended surgical removal by way of either the mouth or the submaxillary region, depending on the region through which the tumor can more easily be removed. Excision of the tumor, with the addition of radium, diathermy or cauterization as indicated, resulted in an average of seventy-nine and four-tenths months of life after operation. Among the cases of malignant tumor, of which 220 were reported by New and Childrey, the highly malignant tumors, epithelioma and sarcoma, were treated by irradiation, both by applying the irradiation within the tumor and by applying it externally over the neck. The growths of low grade were removed by diathermy and excision by cautery, followed by removal of the lymph nodes of the neck. In 32 cases of lymphosarcoma, the average length of life after operation was eighty-four and nine-tenths months. A large number of patients were living at the time of the survey, some of whom had remained cured for three, five and seven years.

Bruzzone [21] reported 31 cases of malignant tumor of the tonsil. Twenty-five of the tumors were primary and 6 metastatic. Of the primary tumors 7 were sarcomas. The author expressed the belief that tobacco and alcohol are possible factors in the origin of these malignant tumors. Carcinomas were prevalent among patients more than 50 years of age, whereas sarcomas were prevalent among patients less than 30 years of age. The author also found that many of the patients were painters, although none gave evidence of lead poisoning.

The first symptom noticed by the patients was enlargement of the upper cervical lymph nodes. Earache was also present early in many cases; dysphagia presented itself late in the course of the disease. The author found that treatment was of no avail, except to prolong life and alleviate symptoms.

LARYNX

Tapia [22] attributed the greater frequency of occurrence of carcinoma of the larynx in men to the fact that more men than women smoke. Four of six women with carcinoma of the larynx seen by him were smokers. He is carrying out experiments on animals to determine

21. Bruzzone, C.: Tumori maligni delle tonsille palatine, Ann. di laring., otol. **31**:176, 1931.

22. Tapia, A. J.: Cancer of the Larynx, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:75, 1932.

whether nicotine or the distillation products of the tobacco leaf are the etiologic factor. He stressed the importance of biopsy in all cases. However, this should be followed by immediate operation whenever carcinoma is present, to avoid spreading the disease. Biopsy may be impossible or unsatisfactory, but the presence of carcinoma may appear to have been proved clinically. In such circumstances, Tapia wrote, he prefers laryngofissure for the purpose of determining the exact diagnosis. He stated his belief that operation is the treatment of choice, and that it should vary with the degree of malignancy and the extent of the tumor. He performs laryngofissure when the lesion is limited to one vocal cord, but if the cord is fixed and completely involved, he prefers hemilaryngectomy if the patients are less than 30 years of age, and laryngofissure if they are older. For basal cell tumor he uses radium within the larynx; if small lymph nodes are involved, he performs hemilaryngectomy. If the lesion involves the epiglottis, he performs subhyoid pharyngotomy. Hemilaryngectomy is the procedure of choice if the lesion has spread upward or downward from the vocal cord without involving the anterior or posterior commissure. Tapia has devised an operation for epitheliomas that involve the anterior commissure and anterior portion of the cords; he calls this operation anterior hemilaryngectomy. Two transverse incisions are made, one above the hyoid bone and one below the cricoid cartilage, with a median line incision crossing the two. The anterior portion of the thyroid cartilage is removed and the skin sutured to the cut edge of the cartilage. The resulting laryngeal stoma is closed two or three weeks later by a plastic operation. Four such operations have been performed, with good results. Laryngectomy is advisable when one entire side of the larynx and either the anterior or the posterior commissure is involved, when the tumor spreads to the epiglottis or when it has gone through the laryngeal wall. Tapia expressed the belief that this operation is technically possible even when lymph nodes are involved or when the tumor extends around the larynx. Laryngectomy is contraindicated if the lesion invades the adjacent structures or those in the vicinity of the large vessels. Operation should be tried whenever there is the least hope of success. The technic of laryngectomy used is that of Gluck. The author performed laryngectomy on 190 patients up to October, 1929, with an operative mortality of 6 per cent and recurrence in 35 per cent of cases. If operation was refused, if the lesion was inoperable or if it recurred, he used irradiation.

Jackson and Babcock [23] presented a complete description of their technic for total laryngectomy. The procedure included a transverse

23. Jackson, Chevalier, and Babcock, W. W.: Laryngectomy for Carcinoma of the Larynx, S. Clin. North America **11**:1207 (Dec.) 1931.

incision in the skin at the level of the hyoid notch, as contrasted with the more prevalent T-shaped or I-shaped incision. They removed the larynx from above downward, with a separate opening in the skin for the tracheostomy, thus diminishing the danger of not obtaining primary healing. Enough of the cricoid was saved whenever possible to insure a patent opening of the tracheal stoma. The authors expressed their preference for fine silver wire rather than catgut or silk when suturing the pharyngeal stoma, because this is less likely to cause infection and breaking down of the tissues. The pharynx was sutured together in a vertical line with interrupted sutures. This diminishes the chance of a fistula forming. Regional anesthesia was used. The authors protected the areas exposed during the operation by packs dipped in a solution of hydrochloric acid, 1:200. Bismuth powder was dusted over the pharyngeal surface after the wound was closed. They stated the belief that this procedure diminishes infection from the pharyngeal fluids. Preoperative oral and nasal hygiene is stressed. To date, 85 per cent of the patients have been free from recurrence.

Tucker [24] gave a comprehensive review of early intrinsic carcinoma of the larynx. He stressed the necessity for early diagnosis and enumerated the different diagnostic factors, of which biopsy is the most important. He described what may be called an intrinsic area in the larynx, involving the anterior two thirds of each vocal cord and the anterior commissure. Carcinoma of this region is more susceptible to successful treatment by conservative means. The condition of 30 patients treated by laryngofissure was reviewed. The author's technic, which is a slight variation of that of Jackson, is described, as is Jackson's technic for tumors of the anterior commissure, and St. Clair Thomson's technic is briefly mentioned. When the growth was limited to one vocal cord, the author, after exposing the growth through a thyrotomy opening, dissected it out with the internal perichondrium and 0.5 cm. of healthy mucosa around the edges. If the growth involved the anterior commissure, he followed Jackson's technic, which consists of not opening the internal perichondrium until the portion containing the tumor has been completely dissected free from the cartilage. At the time of writing, 25 patients had been well for more than one year, and 2 patients had had recurrences. Eight of the 25 patients had been well for more than four years since operation. The longest time that any patient had lived after operation had been seven years.

24. Tucker, Gabriel: Early Intrinsic Cancer of the Larynx, Diagnosis and Treatment: Observation on Laryngofissure as a Method of Treatment in a Series of Cases, Ann. Otol. Rhin. & Laryng. **41**:36 (March) 1932.

Furstenberg [25] reviewed carcinoma of the larynx generally. He noted that 75 per cent of 135 patients with this disease observed at the University of Michigan were men whose occupations required them to make excessive and improper use of their voices. He stated as his belief that misuse of the voice, chronic laryngitis and syphilis are factors of significance in the etiology of carcinoma of the larynx; also that the number of cases is increasing, especially among younger persons. An early diagnosis of the condition unfortunately is rare. This is due not only to the patient's carelessness but also, Furstenberg stated, to the insufficient awareness of the average physician. He found that about 50 per cent of the patients refused treatment, and stated that this also is partly due to the fact that physicians do not realize the possibilities of operation in this type of disease. Biopsy is an essential preliminary step to any operation, and the author expressed the belief that laryngofissure and laryngectomy are the treatments of choice. He has not found irradiation very satisfactory. Furstenberg expressed definite preference for laryngectomy, as it entails fewer recurrences. He stated that it is occasionally possible to obtain cure by endolaryngeal removal, but that wide experience is needed for this type of treatment. He stated that he did not think that histologic study of the cell type can be used as a guide to the type of intervention. All of his patients on whom laryngectomy has been performed have been able to fill useful places in life.

Kemler [26] gave a brief review of the literature on the treatment of carcinoma of the larynx. He stated the belief that operation is to be preferred to irradiation. He used a modification of laryngectomy in two stages (New) and laryngofissure (St. Clair Thomson). In 3 cases, operation was successful.

Patterson [27] reviewed 7 cases of carcinoma of the larynx in which operation was performed by the window method. He advocated this procedure in cases in which the growth is too extensive for thyrotomy, but offered some hope of success with a less radical procedure than laryngectomy. The technic which he followed was that of Lack, with slight modifications. This method can be used in cases in which the anterior commissure is involved, with one or both vocal cords, or in which the growth extends into the subglottic region. If the growth

25. Furstenberg, A. C.: Carcinoma of the Larynx, J. Michigan M. Soc. **30**:770 (Oct.) 1931.

26. Kemler, J. I.: Treatment of Carcinoma of the Larynx with Report of Cases, South. M. J. **24**:1053 (Dec.) 1931.

27. Patterson, Norman: A Plea for the "Window" Resection Method in Dealing with Certain Types of Laryngeal Carcinoma, with a Clinical History of Seven Cases, J. Laryng. & Otol. **47**:81 (Feb.) 1932.

involves the posterior portion of the larynx, the author prefers laryngectomy. After a portion of the cartilage overlying the tumor has been removed, the extent of the tumor is determined before the cavity is opened. This is done with the help of an assistant, who marks the contour of the tumor with the forceps through a directoscope. One patient had previously had a laryngofissure, followed by a small window opening and diathermy under suspension. A second larger window was made, and the patient has remained well for nine years. Two patients died of bronchopneumonia following operation; 1 patient has been well for five years and 1 for three and a half years; 2 patients died of other diseases, and did not have a recurrence, and 1 patient died from recurrence. This patient refused laryngectomy, although the growth was extensive. The modification of Lack's method by Patterson consists of the formation of a lateral skin flap, which diminishes the percentage of laryngeal fistulas. The author stated that if patients are properly selected this procedure offers as good a prognosis as laryngectomy, and the patient maintains a useful voice.

Gunsett [28] presented the results of roentgen treatment in carcinoma of the larynx between 1922 and 1927. The lesion usually recurs within three years after treatment, so that practically all patients who have been well for three years may be considered cured. He adopted Regaud's technic of protracted fractional roentgenotherapy with slight variations, and treated 23 patients. The condition of all was advanced, and in most cases inoperable. Four of 10 patients with intrinsic carcinoma of the larynx have remained well from four to nine years after operation. Of 13 patients with extrinsic carcinoma of the larynx only 1, who was treated by radium, survived. In even far advanced cases the author was able to cause temporary disappearance of the primary lesion by using prolonged, enlarged doses of radium. For limited lesions he found that small, short doses were successful. The treatment in each case is described in detail.

Coutard and Baclesse [29] proved the importance of roentgen rays when making a diagnosis of malignant diseases of the larynx and hypopharynx. They first described the normal roentgenographic appearance, illustrated by means of reproductions of roentgenograms and diagrams, then the changes brought out in this appearance by the malignant lesion, and finally the progressive return to normal when the

28. Gunsett, A.: Ueber Fernresultate beim fraktioniert bestrahlten Larynxkarzinom (1922-1927), Röntgenpraxis **4**:214 (March) 1932.

29. Coutard, H., and Baclesse, F.: Roentgen Diagnosis During the Course of Roentgen Therapy of Epitheliomas of the Larynx and Hypopharynx, Am. J. Roentgenol. **28**:293 (Sept.) 1932.

patient is undergoing roentgen therapy. The authors reported 6 illustrative cases. They stated the belief that roentgenograms can aid in early diagnosis if it is impossible for the patients to be seen by a laryngologist, or if the tumors involve the ventricle of Morgagni, the preepiglottic thyrohyoid space, the base of the pharyngolaryngeal groove, the posterior portion of the cricoid cartilage and the postero-inferior wall of the pharynx; tumors at these sites sometimes cannot be seen even by an experienced laryngologist. Roentgenographic examination also permits determination of the lower border of the lesion, its invasion of cartilage and its probable point of origin, thus assisting one in deciding on the treatment.

Speiser [30] described pachyderma laryngis as a precarcinomatous condition. Two cases of pachyderma laryngis were traced for fourteen and thirty-one years, respectively, by the laryngologist, biopsy often being made during this period. In both cases carcinoma suddenly developed after these long intervals. Both patients were heavy smokers, and had leukoplakia of the mouth and tongue as well as of the larynx. Only 2 similar cases were found reported in the literature. Speiser considered that pachyderma and leukoplakia are synonymous, and that leukoplakia of the larynx is a precarcinomatous condition, although it has less tendency to malignant degeneration than has oral leukoplakia. He stated his belief that papilloma and leukoplakia are closely allied conditions. As a result of his experience with these 2 cases in which biopsy was frequently performed without injurious results, he stated that biopsy does not stimulate malignant degeneration.

Figi [31] reported 6 cases of chondroma of the larynx. He reviewed the literature, and found reports of only 71 other cases. Seven cases were observed at the Mayo Clinic. The pathologic changes were considered. The tumors are essentially benign, but may become clinically malignant. The symptoms occur late in the disease, and consist of either mechanical obstruction or the appearance of a mass external to the larynx, and endolaryngeal examination reveals a smooth, hard, rounded tumor with apparently normal mucosa and marked venous circulation on the surface. If subglottic, the growth is often not visible. Roentgenograms are valuable in the diagnosis. Biopsy is the only method of obtaining a positive diagnosis.

The treatment of choice is surgical diathermy, which varies according to the situation and size of the tumor. Conservative procedures

30. Speiser, Felix: Zur krebsigen Entartung der Pachydermia laryngis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:391, 1932.

31. Figi, F. A.: Chondroma of the Larynx; Report of Six Cases, Ann. Otol. Rhin. & Laryng. **41**:367 (June) 1932.

usually can be employed, because of the benign nature of the growth. Six cases were reported in detail; 3 patients were still well from one to two years after operation. One patient refused operation, 1 died of pneumonia following the first stage of laryngectomy and another died of local recurrence of the growth six years after the first operation, having refused a second operation.

Katz [32] considered the various forms of treatment in use for multiple papillomas of the larynx. Treatment had consisted of an external operation, such as thyrotomy, and internal operation by direct or indirect laryngoscopy. Operation is not satisfactory because of the high number of recurrences. When thyrotomy is used, the number of recurrences is even greater than when endoscopy is used; the percentage of operative mortality is greater, as well as the percentage of permanent injuries to the larynx. Radium has not given clearcut results, and entails a definite risk of perichondritis and subsequent stenosis. Roentgen treatment has not given satisfactory results. Cauterization and fulguration are followed by recurrences just as often as are surgical procedures. Both general and local medication have been tried, with varying results. Katz has given magnesium oxide by mouth in 3 cases, reports concerning which have been published. This form of treatment was used by Claoui in 1911 with success. Katz combined operative removal with internal medication in his cases. In none had there been recurrence at the time of the report (time elapsed since removal of the papilloma not given). He stated his belief that the effect of the magnesium oxide is attributable to reestablishment of normal metabolism in the cells of the mucosa.

Schmiegelow [33] expressed the belief that any type of active treatment of papillomas of the larynx of children is unsatisfactory and may actually be dangerous. He advised tracheotomy whenever necessary, and stated his belief that the condition will heal spontaneously in time. For adults he has used the galvanocautery with success. He suggested that irradiation might be successful in the hands of experienced operators.

Hitz and Oesterlin [34] reported a case of multiple papillomas of the larynx. The patient died from pulmonary metastasis. There was no evidence that the metastasis had progressed through the usual channels, and the condition was considered to be aerial metastasis.

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32. Katz, Benjamin: Treatment of Papillomas of the Larynx with Calcined Magnesia, Ann. Otol., Rhin. & Laryng. **41**:202 (March) 1932.

33. Schmiegelow, E.: Bemerkungen über Larynxpapillome und ihre Behandlung, Monatschr. f. Ohrenh. **65**:1291 (Nov.) 1931.

34. Hitz, H. B., and Oesterlin, E.: Case of Multiple Papillomata of Larynx with Aerial Metastasis to Lung, Am. J. Path. **8**:333 (May) 1932.

TRACHEA

Barth [35] reported a case of recurring tumor of the trachea. A report of this case was previously published by Minnigerode in 1924. The history dated back to 1916. A biopsy performed in 1920 revealed the presence of an endothelioma. In 1923 the tumor was removed. It was mentioned at the time that the structure was similar to that of a mixed tumor of parotid type. In 1931 a tumor appeared to the left of the scar in the neck, and a recurrence was also found in the trachea. The histologic structure of the tumor was again studied, and the growth was found to be a mixed tumor of parotid type, which the author thought had arisen from the mucosal glands. The slow, essentially benign course of the growth and the encapsulated nature of the metastatic nodes support this diagnosis. At the time of writing the tumor was again recurring.

ESOPHAGUS

Guisez [36] reported the accidental finding of carcinoma when performing esophagoscopy to ascertain the presence of foreign bodies or hemorrhage. These tumors were well developed but too small to cause dysphagia, and were discovered sufficiently early for treatment with radium to be fairly successful.

Patterson [37] reported a case of myxofibroma of the esophagus. On reviewing the literature he found that benign tumors of the esophagus are extremely rare. They consist of adenomas, aberrant thyroid tissue, dermoid, epithelial and other cysts, fibromas, hemangiomas, leiomyomas, lipomas, lipomyomas, myomas, papillomas and polyps. The two last-named growths occur most commonly. Reports concerning only 61 of these were published between 1717 and 1932. These growths are usually single and pedunculated. Patterson reviewed the etiology and symptoms, which usually are very slight. The patient first notices the tumor when regurgitating it into the mouth or larynx, or because of the appearance of cyanotic symptoms. Diagnosis is most often made by esophagoscopy, occasionally by means of roentgenograms. Treatment consists of removal through the esophagoscope.

Ginsburg [38] reported a case of multiple papilloma of the esophagus. This condition is extremely rare. In healthy patients it gives rise to a

35. Barth, Hermann: Zur Kasuistik der Trachealtumoren, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:583, 1932.

36. Guisez, J.: Quelques formes anomales du cancer de l'oesophage, en particulier, les formes latentes, Bull. et mém. Soc. de chir. de Paris **24**:166 (March) 1932.

37. Patterson, Ellen J.: Benign Neoplasm of the Esophagus: Report of a Case of Myxofibroma, Ann. Otol., Rhin. & Laryng. **41**:942 (Sept.) 1932.

38. Ginsburg, L.: Multiple Papillomas of the Esophagus, Arch. Otolaryng. **14**:570 (Nov.) 1931.

fluoroscopic image which is similar to that of carcinoma. Esophagoscopy is the only sure method of diagnosis. The author stressed the importance of performing esophagoscopy in the presence of all lesions attributable to the esophagus.

Cleminson [39] reported 75 cases of malignant lesions of the hypopharynx and esophagus in which treatment was given at the Middlesex Hospital during the last five or six years. Ten of the tumors were in the hypopharynx or postcricoid region, and 9 of these occurred among women. Treatment was by interstitial implantation of radium needles, following exposure through an incision along the anterior border of the sternocleidomastoid muscle without opening into the pharyngeal cavity. The results were poor, the average length of life following treatment being only seven and three-tenths months. The author stated that endoscopic irradiation will be associated with this method in the future. Of 65 true esophageal carcinomas, 38 were of the middle third, 11 of the upper third and 16 of the lower third of the esophagus. Only 16 occurred in women. Specimens for biopsy were obtained in 53 cases, and all except 1 myeloma and 2 round cell sarcomas proved to be squamous cell epitheliomas. Endo-esophageal irradiation was given by means of sounds, and later Souttar tubes were implanted. It was found possible to repeat irradiation several times without poor results. The prognosis, however, was uniformly unfavorable. In 4 cases peritumoral, interstitial implantation of radium through the thorax following artificial pneumothorax was done. This procedure has been abandoned on account of the poor results.

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39. Cleminson, F. J.: Ueber die Behandlung bösartiger Erkrankungen des Oesophagus mittels Radium, Monatschr. f. Ohrenh. **65**:1406 (Nov.) 1931.

Abstracts from Current Literature

Ear

EYE AND EAR IN "SEASICKNESS." MAYNARD M. METCALF, Arch. Ophth. **8**:269 (Aug.) 1932.

The mechanics of seasickness have always been of interest. In 1930, Lebensohn, in discussing carsickness, made the following statement: "From these experiments, one can definitely conclude that carsickness is due to labyrinthine stimulation rather than to optic nystagmus. Optic nystagmus is easily tolerated and is not accompanied by depressive gastric phenomena. The impulses from the labyrinth, however, are depressive. Though carsickness is based on labyrinthine irritation, it is nevertheless true, I believe, that errors of refraction and of muscle balance predispose a person to this malady." Metcalf believes that Lebensohn's statements are not adequate—that carsickness is more complex than he indicated.

Metcalf himself was his best subject because of his unusual susceptibility to seasickness.

By means of fixation tests and deliberate stimulation with nicotine, he carried out various experiments, which allowed him to draw the following conclusions: 1. Stimulation of the eye, apparently, and stimulation of the retina with changing images and without much, if any, motion of the eyeball can produce nausea, dizziness and, if persisted in, vomiting. This seems in disagreement with Lebensohn's conclusion, though he emphasized motions of the eye rather than retinal images. 2. Tobacco seems to render the same semicircular canals hypersensitive. 3. Overstimulation of normal balancing organs probably is an efficient cause of dizziness, nausea and vomiting, if exceedingly slight stimulation of balancing organs hypersensitized by tobacco can produce the same effects. 4. Symptoms of the ear (dizziness) usually precede symptoms of the stomach (nausea) in the onset of seasickness. 5. Excessive motion, as on shipboard or on a railway train, can produce seasickness during sleep or in the dark, indicating that retinal stimulation is not necessary to produce it. 6. While either stimulation of the eye or stimulation of the semicircular canals can produce seasickness, it is probable that both types of stimulation are generally involved. 7. The matter is still more complex, for there seems to be sufficient indication that previous disturbance in the stomach, due to indigestible food or too much food, may increase liability to seasickness under proper stimulation. SPAETH, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

SOME EFFECTS OF HETEROPLASTIC TRANSPLANTATION OF THE EAR VESICLE IN AMBLYSTOMA. DOROTHY RICHARDSON, J. Exper. Zool. **63**:413 (Oct. 5) 1932.

Heteroplastic orthotopic transplantation of the ear between Amblystoma punctatum and A. tigrinum embryos of the same age, before invagination of the otic vesicle, was done to study the effect of the new environment on the grafts and the effect of the grafts on the development of structures in the hosts. The punctatum vesicle transplanted on tigrinum, while smaller than the normal ear of the host, exceeds in size the normal ear of the donor, possibly due to a stretching of the labyrinth epithelium, since it has more room to expand. The tigrinum vesicle transplanted on punctatum becomes larger than the normal ear of the host, but is smaller than that of the donor control, owing probably to the mechanical limitation of its environment. The tigrinum transplant does not induce the formation of a cartilaginous capsule in proportion to its size, possibly due to the lack of a sufficient number of cartilage-forming cells in the host. The punctatum ear on tigrinum becomes enclosed in a capsule which is large in proportion to the size of the labyrinth. The tigrinum chondroblasts may be more numerous or more active.

The basi-occipital and quadrate cartilages show no change in amount of cartilage, but some shift in position. The muscles which have their origin on the capsule of the ear are of the same size on the normal side as on the one operated on.

Hyperplasia or hypoplasia is produced on the side of the medulla next to the graft, in punctatum and tigrinum, respectively. The response occurs mainly in the area acustica. No change in Mauthner's cell can be detected. Hyperplasia which may have occurred in the cerebellum is not sufficiently great to be evident.

The results show that the growth of the grafted ears themselves is modified, apparently by the difference in the amount of space afforded in each instance, and that there is a response in the cartilaginous capsule and in the area acustica of the medulla, but none in the other cartilages adjoining the capsule or in the muscles attached to it.

WYMAN, Boston. [ARCH. NEUROL. & PSYCHIAT.]

CORTICAL CENTERS OF THE LABYRINTH. E. A. SPIEGEL, J. Nerv. & Ment. Dis. **75**:504 (May) 1932.

Cortical centers for the labyrinthine impulses have not as yet been thoroughly established, although excitation of the labyrinth leads to distinct sensations of dizziness. Experiments of Magnus and Rademaker support the idea of the frontal lobe as the terminal station of vestibular impulses, while Mills and Monakow supposed it to reside in an area behind Wernicke's center. The author, making use of the works of Baglioni, Amantea, Alimenti and others on the increased reflex excitability induced by strychnine, based his study on twenty-eight dogs and cats in which to different circumscribed cortical areas were applied blotting paper soaked with a strychnine solution stained with toluidine blue in order to recognize undesirable spreading of the strychnine. In order to stimulate the labyrinth, the animals were rotated in a Bárány chair. In these experiments the author found that parts of the arcuate gyrus behind the sylvian fissure, corresponding to the parts of the temporal lobe in man which adjoin the occipital and parietal lobes, if soaked with strychnine for from half an hour to eight hours would be hypersensitized to such an extent that rotation of the animal produced not only typical labyrinthine reflexes but also convulsions. Spasms of the face and other parts of the body developed thereafter in some cases. While loud noises could produce similar attacks, painful stimuli and violent concussion, such as striking the board with a hammer, did not produce such attacks. However, the author succeeded in producing these reflex convulsions in only fourteen of his twenty-three experiments, and considered that in the others the cortical excitability had not been sufficiently increased. He found that dogs responded more satisfactorily to the experiment than cats, of which only half responded with epileptiform convulsions after rotation. Passive movement of the eyes in a horizontal plane and irritation of the central trunk of the vagus nerve by a faradic current did not produce convulsions. In spite of the total extirpation of the cerebellum, it was still possible to produce convulsions by labyrinthine stimulation. From these experiments the author thinks that cortical representation of the labyrinth has at least been established in a part of the temporal lobe, although the more exact limits will require further study for their determination.

HART, Greenwich, Conn. [ARCH. NEUROL. & PSYCHIAT.]

PHYSIOLOGY OF THE LABYRINTH IN MAN. P. VOGEL, Arch. f. d. ges. Physiol. **230**:16, 1932.

The author stimulated the labyrinth in normal persons by a direct current. The directions of the falling reactions depend on the position of the head, as described by Bárány. The chronaxia of the vestibular apparatus was determined as between 10 and 20 sigma.

SPIEGEL, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

FISTULAR SYMPTOM WITHOUT FISTULA. T. PAUS, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **132**:128 (Aug. 23) 1932.

By a fistular symptom without a fistula Paus means a fistular nystagmus occurring with an intact tympanic membrane in the absence of the anatomicopathologic substratum of the real fistular symptom. He reports a case which concerns an elderly patient in whom, after bilateral otitis media of short duration, chronic catarrh of the middle ear had developed. The patient sought medical attention because of sensations of pressure and accumulation of fluid in the right ear. It was usually impossible to remove any secretion from the ear by repeated paracentesis. The temporary fistular nystagmus was observed about six weeks after the patient came under observation, during a period when he complained of vertigo. The nystagmus was a typical compression nystagmus to the diseased side, followed by a nystagmus to the opposite side after the release of pressure. It was unusual in respect to the ease with which it was provoked (light pressure on the tragus, Valsalva) and its intensity. This typical compression nystagmus has not been observed in all cases of fistular symptom with intact tympanic membrane, but seems to be the rule in those in which there is secretory catarrh. This etiology is indicated in this case by the result of the examination of hearing and by the intact vestibular function before and after disappearance of the fistular symptom. The author thinks that through catheterization of the tube a tenacious mucous plug was forced against the fenestra rotunda, pressing it in. Under these conditions a sudden increase in intratympanic pressure resulting from compression in the auditory meatus or the tube would disturb the relation between the two windows, and the increased intratympanic pressure would be transmitted to the labyrinth fluid, provoking the fistular symptom.

EDITOR'S ABSTRACT.

NATURE OF MUCOSA AND PNEUMATIZATION. K. WITTMAACK, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **132**:261 (Aug. 23) 1932.

Wittmaack disagrees with Schwarz's interpretation of the individual morphologic differences observed in the mucosa of fetuses and of the new-born. The latter regards these as signs of genotypic differences in the nature of the mucosa. The author has seen the differences described by Schwarz, but attributes them to postmortem changes of varying intensity and possibly of somewhat varying nature. This opinion was confirmed by studies of the middle ear in new-born rabbits. In each animal the middle ear on one side was fixed immediately after decapitation and used as a control for the middle ear on the other side, which was fixed after a six, twelve or twenty-four hour interval. The postmortem changes, especially in the subepithelial tissue of the mucosa, produced morphologic pictures identical with those regarded by Schwarz as genotypically different morphologic forms. The author thinks that in the mucosa of the middle ear, as in all tissues, the individual genotypic anlage is not morphologically distinguishable and can be recognized only in the different forms of reaction to the various environmental or so-called phenotypic influences. When morphologic differences are seen, phenotypic influences have already been at play. All changes in the morphology of the mucosa except very slight ones which may be due to individually different influences of the eustachian tube or of the nasopharynx are due to early inflammatory processes. Irritants which affect chiefly the epithelial layer provoke chiefly hyperplastic reactions of the mucosa; those which affect chiefly the subepithelial layers determine mainly hypoplastic changes. Either of these two opposing phenotypic factors, or possibly both, may determine the development of the mucosa. Because of the genotypically determined individual susceptibility of the mucosa, the intensity of the change produced in different persons by inflammatory irritants of the same degree is variable. The intensity of the change may vary in different parts of the middle ear. The stage in the development of the mucosa and in the process of pneumatization in which the phenotypic factors come into play is variable. The interaction of all these factors explains the wide variety of pneumatization types which occur.

EDITOR'S ABSTRACT.

So-Called Persistent Cartilaginous Foci in the Region of the Bony Labyrinthine Capsule. F. Altmann, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **132**:297 (Sept. 21) 1932.

Altmann reports the postmortem finding of an island of cartilage in the upper wall of the internal acoustic meatus in a child aged 2 days, with microtia and congenital atresia of the external auditory meatus on the left side. The island of cartilage was 1.5 mm. in diameter and nearly spherical. It was rich in cellular elements. It was sharply defined from the adjacent bone tissue by a perichondrium-like covering of connective tissue. According to Bast, five ossification centers are involved in the development of the bony internal acoustic meatus, all of which are fused in the 19½ weeks old embryo. Normally there are no cartilage rests in the superior wall of the acoustic meatus after this period. However, Altmann thinks it possible to attribute the island of cartilage to a cartilage rest which is usually present only a short time and rapidly disappears. Analogously in the course of endochondral ossification of the long bones, islands of cartilage are sometimes excluded during the fetal period or later by injurious influences and may persist while the remainder of the cartilage ossifies. They constitute simple chorista or may proliferate and give rise to tumors. Whether the case reported concerns such a cartilage rest remains unanswered, but in Altmann's opinion this is at least histologically possible. He reports two other cases which show that a retardation of ossification in the fusion zone of Bast's ossification centers may occur under certain circumstances and a certain section of cartilage accordingly be preserved longer.

Editor's Abstract.

"Subjective Auscultation" of Mastoid Process. L. T. Lewin, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **132**:305 (Sept. 21) 1932.

Lewin says that percussion of the mastoid process, which is ordinarily used for objective determination of a difference in the percussion sounds on both sides, may be employed to determine the sensations perceived subjectively by the patient. In many cases in which no difference in the percussion sound can be objectively perceived even by the practiced ear, a difference can be clearly and precisely perceived by the patient. In every one of the numerous cases in which the result of the subjective auscultation was positive,, the diagnosis of mastoiditis could be confirmed in clinical examination and in surgical intervention, even when the objective auscultation was negative. Therefore, when the patient states with certainty that in comparative percussion of the mastoid process on both sides he perceives a diminished resonance on the diseased side, it has an almost pathognomonic significance for the diagnosis of mastoiditis. A negative result, however, does not exclude mastoiditis. Besides its value in confirming objective auscultation and in indicating a mastoiditis when objective percussion is uncertain, it has the advantage over the objective method of not requiring absolutely quiet surroundings. In subjective auscultation a lighter percussion than in objective ausculation suffices, and the former can therefore be used in some cases in which the latter cannot.

Editor's Abstract.

Inner and Middle Ear in Cases of Malformations of Brain and Skull. B. G. Turkewitsch, Frankfurt. Ztschr. f. Path. **42**:415, 1932.

In a detailed article, the author points out certain correlations between the structures of the labyrinth and the brain. He believes that according to structural changes it may be possible to determine the time of the interruption of the normal development of the brain in cases of anomalies of the brain. Also, the changes in the brain per se may lead to certain conclusions as to what changes may be expected in the labyrinth. The author recommends experimental animal research by destruction of the brain in a very early period of the development and simultaneous investigation of the labyrinth in these instances.

O. Saphir. [Arch. Path.]

PERSISTENT RETRO-AURICULAR OPENING CLOSED BY HUNGARIAN SEMICIRCULAR FLAP PLASTIC OPERATION. E. SZOKOLIK, Monatschr. f. Ohrenh. **66**:1058 (Sept.) 1932.

Szokolik successfully used the Hungarian semicircular flap plastic operation to close a persistent retro-auricular opening. He presents a brief description of the operation with diagrams. He thinks this method is satisfactory for closing any dry retro-auricular opening.

EDITOR'S ABSTRACT.

PRIMARY ISOLATED DISEASE OF BULBUS VENAE JUGULARIS. F. FREMEL, Monatschr. f. Ohrenh. **66**:1234 (Oct.) 1932.

Fremel thinks that an important mode of pathogenesis of primary bulbus thrombosis is direct contact with the infection in the peribulbar cells of the mastoid process, called "threshold cells" by Bayer. By primary bulbus thrombosis he means only the condition in which the sinus is normal while the central end of the internal jugular vein is bloodless or thrombosed (the common facial vein being ligated). In some cases of mastoiditis the infection develops earlier or more severely in the peribulbar cells, and so reaches the bulbus and the adjacent parts earlier, resulting in primary isolated bulbus disease with or without thrombosis. This view receives some support in the fact that primary bulbus disease occurs chiefly in acute otitis. The author reports a case of primary bulbus disease in which this mode of pathogenesis seemed to be confirmed by serial section of the temporal bone.

EDITOR'S ABSTRACT.

OTOGENOUS THROMBOSIS OF CAVERNOUS SINUS WITH RECOVERY FOLLOWING ORBITAL PERFORATION. B. LARSEN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:663 (July 22) 1932.

Larsen reports the case of a boy, aged 3, in whom thrombosis of the cavernous sinus developed in connection with acute otitis media and mastoiditis. The symptoms were typical: chills, remittent fever, edema of the eyelids, exophthalmos, ophthalmoscopic changes and so on. About seven weeks after hospitalization, spontaneous perforation of the bilateral orbital abscesses resulted in immediate improvement and rapid recovery. The author found only two other cases in the literature in which the healing of a thrombosis of the cavernous sinus resulted from the spread of suppuration into the orbit and final spontaneous perforation of the orbital abscesses.

EDITOR'S ABSTRACT.

NYSTAGMUS OF VASOMOTOR ORIGIN AND ITS DIFFERENTIATION FROM LABYRINTHINE NYSTAGMUS. O. MUCK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:668 (July 22) 1932.

Muck previously reported that in many test persons mechanical, thermal or electric stimulation of the vertebral or the radial arteries (whose periarterial plexus is innervated by the inferior cervical ganglion of the sympathetic nerve) produces a rhythmic horizontal nystagmus. If the result is positive, the white streak sign is seen in the epinephrine probe test. This shows that the experimentally produced nystagmus is of vasomotor origin, which fact is of practical as well as physiologic significance. With the aid of the aforementioned stimuli, a spontaneous nystagmus not of labyrinthine origin can be made to disappear. The author reports several cases in which a spontaneous nystagmus was made to disappear through rotation of the head, pressure on the radial artery or faradization or freezing of the region of the radial artery. In all these cases, prior to the experimental stimulation the epinephrine probe test had repeatedly shown the reflex phenomenon of the white streak sign. This permitted the conclusion that the nystagmus in all cases was of vasomotor origin. That the nystagmus could not be of labyrinthine origin was shown by the fact that in several cases of nystagmus of certain labyrinthine origin, the aforementioned stimuli had no influ-

ence on the nystagmus. Probably the nystagmus that disappears on stimulation of the radial or the vertebral arteries is due to a disturbance in the blood supply in the region of Deiters' nucleus.

EDITOR'S ABSTRACT.

CUPOLA TERMINALIS IN LABYRINTH OF PIKE. F. WÜNN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **22**:481 (June) 1932.

Wünn studied the cupola in the intact ampullae of the semicircular canals in the labyrinth of the pike according to Steinhausen's method, immediately after killing the fish. The experiments and the morphology revealed are discussed in detail and are accompanied by stereophotomicrographs demonstrating the shape and size of the cupola. By the term cupola, the author means only the structure rising above the sensory epithelium of the crista in the ampulla of the semicircular canals, in contrast to Werner and Wittmaack, who designate the membrane extending from the otoliths to the macula in the utriculus and sacculus as the cupola. The author's studies confirmed and amplified the observations made by Steinhausen. The vitally fresh cupola has a complicated morphology and is much larger than formerly assumed. It extends upward to the roof of the ampulla, and laterally lies close to the wall of the ampulla. It is 1.3 mm. high and 1.2 mm. wide. It is 0.6 mm. thick immediately above the crista, and 0.4 mm. thick at the roof of the ampulla. In fixation of the cupola, even with the mildest fixing fluids, severe shrinking of the tissue of the cupola occurs, resulting in a marked change of its shape and size. It may therefore be assumed that the finer histologic structure of the fixed cupola may in no way be compared with that of the fresh unfixed cupola.

EDITOR'S ABSTRACT.

RARE LOCATION OF METASTASIS AFTER SINUS THROMBOSIS. L. HAYMANN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:73 (Sept.) 1932.

Haymann reports a case of an isolated metastasis in a cervical vertebra following otogenous sinus thrombosis. During recovery from the surgical intervention, the patient felt pains in the nape of the neck which radiated toward the scapula and the lower arms. As healing of the surgical wound was normal and there were no cerebral or vestibular manifestations, the pains were considered of rheumatic nature. The pains had almost disappeared when the patient left the hospital. Three months later he experienced a sudden attack of high fever, with a feeling of great weakness, and a simultaneous recurrence of severe pain in both arms and shoulders, especially on the left side. The pains increased, while the temperature gradually returned to normal. Roentgenography showed a disintegration in the region of the sixth cervical vertebra with slight involvement of the fifth vertebra. No significant reaction or atrophy was seen. As there were no indications of tuberculosis, the author considers the process an osteomyelitis originating from the sinus thrombosis. The pains in the nape of the neck, which were the first signs, were misinterpreted. After a period of latency, the osteomyelitis flared up, probably as a result of some movement; the patient worked in a garden.

EDITOR'S ABSTRACT.

Pharynx

GLANDULAR FEVER AFTER TONSILLITIS CURED BY TONSILLECTOMY. STELLA MÜNZ, Monatschr. f. Ohrenh. **66**:1108 (Sept.) 1932.

Münz reports the case of a child, aged 7, with an acute disease of the mucosa of the nasopharynx and throat of about six weeks' duration, with simultaneous severe, painful swelling of all the cervical glands. The course of the disease was marked by repeated rise and fall of the fever, glandular swelling and a transitory attack of polyarthritis. The swelling of the glands always increased with an exacerbation of the disease of the mucosa. They remained enlarged till the end

without abscess formation. There were no demonstrable changes in the other glands, spleen or liver. After tonsillectomy and adenotomy, performed during a remission of acute symptoms, there was a recurrence of fever and swelling lasting two days, followed by recovery. Münz thinks that this might be considered as a lymphatic reaction in acute disease of the adenoid tissue of the tonsillar ring with a tendency to remissions. She thinks it important to emphasize this relation, as the new conception of this clinical picture, especially Lehndorff's, assumes an idiopathic (usually generalized) swelling of the lymph glands, of unknown etiology, with an accidental secondary infection of the adenoid tissue. In cases in which the relation between remittant glandular swelling and disease of the adenoid tissue is evident, extirpation of the adenoid tissue should be undertaken at an opportune moment.

EDITOR'S ABSTRACT.

ENDOCRANIAL COMPLICATION FOLLOWING TONSILLITIS AND PERITONSILLITIS. E. WESSELY, Monatschr. f. Ohrenh. **66**:1190 (Oct.) 1932.

In Wessely's opinion, endocranial complication after tonsillitis and peritonsillitis develops from direct spread of the tonsillar infection outward through the pharyngeal wall and through the parapharyngeal tissue up toward the base of the skull and by way of the oval foramen into the middle cranial fossa. Surgical therapy, if one wishes to prevent threatened endocranial complication, must consist in stopping the infectious process while it is still in the loose connective tissue of the parapharyngeal space. The recognition of inflammatory changes in the parapharyngeal space is therefore of paramount importance; among the symptoms are peritonsillar abscesses under tension and changes in the lateral pharyngeal wall and also on the outside of the neck. With the upward spread of the inflammatory process in the pharyngeal connective tissue spaces, symptoms from the adjacent muscles and nerves usually develop. Rigidity of the jaw is usually found. This may also be found in peritonsillar abscesses. If the rigidity of the jaw disappears while the local symptoms of a peritonsillar abscess continue, it usually indicates perforation of the abscess into the parapharyngeal space. Some of the subjective symptoms are irritation of the trigeminal and lingual nerves. In the author's opinion, the danger of endocranial complication justifies surgical intervention in cases of probable infection of the parapharyngeal space. Incision of the peritonsillar abscess and possibly tonsillectomy are valuable, but must be supplemented by opening of the parapharyngeal space. This may rarely be done from the interior; usually it is accomplished from the exterior. The author describes the method used at his clinic for the opening of the anterior parapharyngeal space.

EDITOR'S ABSTRACT.

SEPTICEMIA FOLLOWING TONSILLITIS. W. UFFENORDE, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:41 (Sept.) 1932.

Uffenorde discusses the hematogenous, lymphogenous and phlegmonous forms of pathogenesis of septicemia following tonsillitis. He thinks that the phlegmonous origin is most common. In this form of pathogenesis the infection originating in the tonsils is spread by a progressive phlegmonous process in the interstitial spaces of the neck, which extends into the parapharyngeal space and sometimes to the exterior. The process may extend to the cerebrum and also, but more rarely, to the mediastinum. Periphlebitis in one or several places, near or far from the primary focus, leads to phlebitis and thrombophlebitis. The author thinks that thrombosis of the smallest veins in the tonsillar region has no rôle in the pathogenesis of septicemia. It may be considered more as a protection against the spread of infection than as an endophlebitic septic focus. The various forms of pathogenesis frequently overlap each other. The author emphasizes that the tonsil may constitute the septic focus as well as the portal of entry of the infection. Diagnosis of septicemia is often difficult. Chills are sometimes lacking in septicemia, and, on the other hand, they sometimes mark the beginning of some

other disease. Careful anamnesis and bacteriologic examination of the blood are valuable. Cytologic examination of the blood is important not only for differentiation from leukemia, agranulocytosis and tonsillitis with the lymphoid cell reaction, but also for control of the blood picture in dubious cases. If the tonsil is the main septic focus, enucleation suffices even if the peritonsillar tissue is also inflamed. In cases in which the spread is lymphogenous or phlegmonous, intervention should be from the exterior and should consist in the thorough airing and draining of all affected interstitial spaces and the parapharyngeal space up to the tonsil and a careful examination of the blood vessels, including the jugular vein and the facialis communis with its branches. Ligation of the jugular vein is not an absolute safeguard against spread of the infection. In case the veins are pathologically altered, the diseased part should be resected after ligation. Ligation of a healthy vein is useless.

EDITOR'S ABSTRACT.

MIXED TUMOR OF THE PHARYNX. R. BÜHR, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:75 (Sept.) 1932.

Bühr describes a mixed tumor of the pharynx removed from the region of the left tonsil, which he considers of epithelial origin. The sharply differentiated capsule of the tumor consisted of connective tissue containing many vessels in the outer part; the major part of the tumor itself was formed by hyaline tissue with a chondromatous appearance. There were several spaces in this tissue which contained one or two cartilage cells. Adjoining it were connective tissue fibers forming a fine network, sometimes having a mucoid content. Of diagnostic significance were long, oval epithelial cells with well staining nuclei, occurring singly and in groups, and which were not attached to a basement membrane. In some places the cells were arranged in cords or tubes of epithelium. In many places the epithelial cells were seen to form veritable transitions to fibrillar connective tissue fibers, which speaks in favor of the epithelial origin of this tissue. According to the histologic structure, the tumor is a connective tissue epithelial tumor derived from mesodermal epithelial germs. Whether the various connective substances are formed according to early embryonic pattern by the epithelium cannot be decided. The occasional malignant transformation of a typical mixed tumor into a carcinoma is also evidence of their epithelial nature.

EDITOR'S ABSTRACT.

TONSILS AND RHEUMATISM. H. BURGER, Nederl. tijdschr. v. geneesk. **76**:1451 (March 26) 1932.

In this clinical lecture, the origin of angina in relation to the functions and the significance of angina in several conditions are discussed. The author reports cases illustrating alleviation or quick cure of a rheumatic condition of long duration by tonsillectomy; however, this effect could not be verified by statistics. Measures other than tonsillectomy have no value. Frequently occurring attacks of angina are also an indication for tonsillectomy in the period between two attacks. In every case of angina with an infectious complication, tonsillectomy must be considered. Rheumatic conditions that began with an attack of angina are often not of too long standing for tonsillectomy to be performed with the desired result. The coexistence of rheumatic conditions together with chronic tonsillitis is an absolute indication for tonsillectomy. The presence of enlarged lymph glands behind the angulus mandibulae verifies a doubtful diagnosis. Tonsillectomy performed by a skilled surgeon is almost free from danger. In two thousand tonsillectomies, only two patients died (in one death was due to the narcosis and in the other, to status thymicolymphaticus). Severe hemorrhages were not seen. Only once was the bleeding so severe that a second operation had to be performed.

VAN CREVELD, Amsterdam, Holland. [AM. J. DIS. CHILD.]

Larynx

LARYNGEAL STENOSIS DUE TO PHLEGMON: RARE SEQUEL OF TONSILLITIS. H. E. MACMAHON, Ztschr. f. Hals-, Nasen- u. Ohrenh. **32**:247 (Nov. 12) 1932.

MacMahon states that the diagnosis of complications of tonsillitis in cases in which the primary infection of the tonsils is not recognized may be difficult or impossible. He reports two cases in which severe swelling of the larynx appeared suddenly and inexplicably in apparently healthy persons. In the first tracheotomy had to be performed five days after the beginning of the laryngeal swelling, and the patient died two days later with symptoms of circulatory disturbance. In the second case the stenosis increased so rapidly that death occurred from asphyxiation within thirteen hours of the onset of symptoms. At necropsy it was found that the laryngeal swelling in both cases was due to a phlegmonous process and not to toxic edema. The infectious focus in both cases was found to be a latent deep-seated tonsillitis which had spread to the larynx through the lymph channels in the form of lymphangitis and perilymphangitis. In both cases the tonsils had appeared normal on clinical examination. The author thinks that these cases are of special interest because they show that an acute laryngeal phlegmon with fatal termination can originate from a latent tonsillitis, and that the diagnosis of primary isolated edema or phlegmon of the larynx cannot be made without thorough examination of the lymphoid tissue of the pharynx.

EDITOR'S ABSTRACT.

TREATMENT OF LARYNGEAL PAPILLOMA. W. PFEIFFER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:280 (Nov.) 1932.

Pfeiffer summarizes the experiences of Spiess' clinic in the treatment of laryngeal papillomas in the last thirty years. Twenty cases in adults and twenty-one cases in children are presented in tabular form. On the basis of this report, the author states that with appropriate and systematically pursued therapy the prognosis for laryngeal papillomas in adults is favorable. The treatment of laryngeal papillomatosis in children requires much patience; temporary failure and frequent recurrences must not prevent the continuation of the treatment till the ultimate goal, freedom from recurrence, is reached. The best therapy is direct or indirect surgical removal of the papillomas in combination with fractionated roentgen irradiation according to the directions of Holfelder. Under some circumstances the application of carbon dioxide snow mixed with acetone may be advisable. Whenever possible the anesthetizing therapy of Spiess should be carried out. It consists of submucous injections of 0.5 per cent solution of procaine hydrochloride into the tumor bed.

EDITOR'S ABSTRACT.

Nose

APPLICATION OF ANGIOSCOTOMETRY IN THE STUDY OF OCULAR LESIONS OF NASAL SINUS ORIGIN. J. EVANS, Ann. d'ocul. **169**:717 (Sept.) 1932.

Evans points out that careful study of the size of the retinal arteries with small test objects, preferably with the stereocampimeter, elicits important early signs of involvement of the optic nerves in diseases of the nasal accessory sinuses.

BERENS, New York. [ARCH. NEUROL. & PSYCHIAT.]

MY SEPTAL METHOD OF OPENING SPHENOID SINUSES. O. HIRSCH, Monatschr. f. Ohrenh. **66**:1098 (Sept.) 1932.

Hirsch describes his septal method of opening the sphenoid sinuses, first described as part of his septal operation for hypophyseal tumors. He considers it the method of choice in those cases in which simultaneous empyema of other sinuses necessitating resection of the nasal conchas makes Hajek's method with resection of the middle conchas undesirable; also in cases in

which bilateral opening in one intervention is necessary. Further, the loss of blood by this method is insignificant. The opening of the sphenoidal sinuses is accomplished essentially by twisting off the rostrum sphenoidale. The initial procedure is that of a customary submucous septum resection, but the detachment of the mucosa is extended to include the last third of the septum and the anterior walls of the sphenoid sinuses. The rostrum sphenoidale is then seen. When the detached mucosalperiosteal layers of the septum have been spread laterally, the openings of the sphenoidal sinuses are usually seen. The anterior walls of the sinuses are resected toward the median line till only a central piece with the rostrum sphenoidale remains. This is twisted off with a Middleton forceps, thereby opening both sinuses. The two sinuses can be easily united by removal of the septum sphenoidale if desired. The layer of mucosa and periosteum covering the anterior walls of the sinuses which is continuous with the detached layers of the septum, closes over the sinuses when the septal layers are returned to their original position. Vertical incisions are made in the anterior membranous walls of the sinuses and enlarged with the conchotome to provide for drainage. If a permanent large opening is desired, a resection of part of the posterior section of the septum is necessary. Hirsch has used this method in 300 cases. It can be used in suppurative or catarrhal inflammations of the sphenoid sinuses. In the former, the pus is aspirated after opening the sinuses, so that it does not get in between the lamellae of the mucosa. EDITOR'S ABSTRACT.

RHINOGENOUS RETROBULBAR NEURITIS WITHOUT CLINICAL SYMPTOMS OF THE NOSE. I. I. TAKACHIROVA and M. M. TER-AGANESIAN, Russk. j. opth. **14**:363 (Oct.-Nov.) 1931.

The anatomic correlation of the accessory nasal sinuses and of the visual organ is described. The differential diagnosis of retrobulbar neuritis of rhinogenous origin and that caused by multiple sclerosis is discussed, and a review of the literature is given.

Two cases are reported. In one of these vision was impaired to counting fingers in each eye. There was an absolute central scotoma. The temporal half of each disk was pale. In the other case complete loss of vision in each eye within a few days was recorded. There was a marked pallor of both optic disks. No cause could be traced in either case. The sinuses were opened and drained on both sides, and there was a marked improvement of vision in both cases after a rather long period (from six to nine months).

The author stresses the importance of this operative intervention in all cases of retrobulbar neuritis of unknown etiology.

SITCHEVSKA, New York. [ARCH. OPHTH.]

Miscellaneous

A NOTE ON THE OPERATIVE TREATMENT OF FACIAL PALSY. CHARLES BALLANCE, Brit. M. J. **1**:787 (April 30) 1932.

Three operations are reported on baboons in which the facial nerve was divided on one side and at least 3 cm. of the nerve was taken away from the aqueduct of Fallopius to prevent union of the divided ends. An anastomosis with the glossopharyngeal nerve was performed in one case and with the auriculotemporal in another. In a third case, 7 mm. of the facial nerve in the fallopian aqueduct was replaced by 7 mm. of the descendens noni nerve. In the first case recovery was almost complete, but associated movements during swallowing were noticed. In the second case, recovery was even more complete and there were no associated movements. In the third case, rapid and complete recovery from the facial palsy was observed; there were no associated movements and no spontaneous spasm occurred. The author believes that the graft operation is much to be preferred to any anastomosis possible. Stimulation of the facial area of the rolandic cortex

and of the nerves in the posterior fossa of the base of the skull was undertaken as a routine in the final examination of each experimental animal. In the first case, stimulation of the facial area of the rolandic cortex gave a normal response in the muscles of the right side of the face. This also occurred in the other two cases. Stimulation of the right facial nerve in the first case, after the animal had been killed, gave no response. Stimulation of the right glossopharyngeal nerve gave good contraction of the muscles of the upper and lower lips and retraction of the angle of the mouth. With a stronger current, the right eyelid closed. Stimulation of the right glossopharyngeal nerve at the lower border of the jugular foramen caused contraction of all muscles of the right side of the face. In the second case, similar stimulation of the right facial nerve at the base of the skull gave no response, and stimulation of the right fifth nerve caused contraction of all muscles of the right side of the face. In the graft operation, stimulation of the right and left facial nerves in the posterior fossa, after removal of the brain, produced equal and full contraction of muscles of the right and left sides of the face.

FERGUSON, Niagara Falls. [ARCH. NEUROL. & PSYCHIAT.]

DISEASES OF TONGUE AND ORAL MUCOSA. C. BUNNING, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **133**:85, 1932.

On the basis of a study of the literature, Bunning presents a survey of the independent diseases of the tongue and the oral mucosa, and of those which are observed as a symptom during some stage in the course of organic disease. Intoxications, specific diseases and tumors are not included. The clinical descriptions of these diseases of the tongue and oral mucosa are arranged under the headings of nutritional disturbances, circulatory disturbances, acute and chronic inflammations and parasitic diseases. The author thinks that the survey shows the importance of a thorough inspection of the tongue and of the oral mucosa for the diagnosis of many internal and other diseases. It is especially valuable for the practitioner who does not have at his disposal the clinical facilities for some of the finer methods of diagnosis.

EDITOR'S ABSTRACT.

OSTEOMYELITIS OF THE UPPER JAW IN THREE INFANTS. W. HERZAU, Klin. Monatsbl. f. Augenh. **90**:55 (Jan.) 1933.

The author states that until recently the subject of osteomyelitis of the upper jaw in infants has not been found very much in the ophthalmic literature. He mentions the articles of D. Bosse and Remky. He thinks that in the majority of the cases the ocular symptoms dominate the picture and that the disease is so rare that the varied signs cause difficulty and can lead to errors in the proper operative handling which make the prognosis unfavorable.

He mentions the possible etiologic factors, namely, an infection in the alveolar border, especially caused by mastitis in the mother, and the rhinologic cause.

The clinical picture shows severe swelling, chemosis, exophthalmos with limitation of motion and fistula, mostly in the infra-orbital margin, in the corner of the eye, in the hard palate, in the alveolar process and, in rare cases, in the nose. The disease is to be differentiated from phlegmon of the tear sac chiefly from its site. The swelling, as a rule, is more severe in the eyelid than over the tear sac. It is most difficult to differentiate the condition from orbital phlegmon in many cases; nevertheless it can be recognized from the site of the fistula, the lack of swelling of the upper jaw and the purulent secretion in the nose.

Frequently there results metastatic suppuration in other bones and organs, as for example in the brain and lungs, so that a mortality of 29 per cent is not to be wondered at. As an ocular complication optic atrophy has been described.

The therapy consists in as wide as possible removal of the infected region through an operative opening, which, for cosmetic reasons, should be done from within when possible.

The author reports three cases.

The first case was in a child, 6 months old, presenting typical symptoms. An incision into the lower orbital margin disclosed pus, but recovery followed only after radical removal of the tooth bud by the rhinologist.

The second case was that of a child, 4 weeks old, who for two weeks had had redness and swelling of the right lower lid which had been treated by an ophthalmologist as a phlegmon of the tear sac. This case presented typical symptoms with high fever. An incision in the lower lid yielded foul smelling pus. Besides this there was a bilateral otitis media. The rhinologist made an incision in the upper jaw under ether anesthesia. Two free sequestrums and a tooth bud were removed. Soon a fistula appeared in the lower orbital margin; later this was incised and a further sequestrum removed. Recovery ensued.

The third case was that of a child, 6 weeks old, who had been sick for a week. The upper lid was swollen, with induration of the lower lid, especially in the region of the tear sac. In the conjunctival sac there was pus. The eyeball was protruded without chemosis or any other abnormal findings. The upper jaw was swollen on the right side, and a purulent secretion was found in the nose. Under ether anesthesia an incision was made through the face over the upper jaw, and considerable pus was evacuated along with a tooth bud. Recovery with optic atrophy resulted.

In discussing the cases the author stated that the external incision in two children resulted in no cosmetic defects. As to whether the removal of the tooth bud can lead to a deformity of the upper jaw as a result of the decreased development on the diseased side only the future can show. In the first child several years later there was no deformity.

H. H. Vail, Cincinnati.

Rheumatic Diseases of the Ear and Upper Respiratory Tract. J. Spira, Monatschr. f. Ohrenh. **66**:990 (Aug.) 1932.

Spira calls the attention of internists to the interesting manifestations of rheumatic disease in the ear and upper respiratory tract, the study of which he thinks might throw light on the problem of rheumatism. In his discussion he divides these symptoms into three groups according to localization. In the first group are rheumatic diseases of the larynx. These rare disturbances occur in articular rheumatism and become manifest in laryngeal pain, edema of the cricoarytenoid joint and restricted movement of the vocal cords. Similar clinical pictures sometimes appear under the influence of cold. The clinical similarity of both forms and their response to salicylate indicates that they are the same clinical identity produced by different causes. The second group consists of diseases of the nerves, especially of the acoustic and current nerves. So-called paralysis of the acoustic nerve is well known. The cochlear as well as the vestibular branch of the acoustic nerve may be affected. This functional disease of the labyrinth has no characteristic symptoms. Diagnosis is based on an anamnesis of exposure to cold or to dampness. This may be only the immediate cause. Similar cases of paralysis occur in infectious disease and in exogenous and endogenous intoxication. In idiopathic cases the existence or a history of articular rheumatism can usually be established. Rheumatic disease of the recurrent nerve is rare. It must be traceable to the influence of cold and not to a catarrhal infection. The third group comprises the neuralgias. A variety of nerves may be involved. The symptoms are variable; earache, tinnitus, headache, vertigo, pain in the sinus region, neck or larynx, coughing and similar disturbances are the most frequent. Examination of the ear and upper respiratory passages reveals nothing to account for the pain; however, symptoms of muscular rheumatism, especially myalgia of the sternocleidomastoid and trapezius muscles, are usually found. While not attempting to answer the question as to whether or not all these variable rheumatic manifestations are symptoms of one general disease, the author emphasizes the importance of cold and disposition as etiologic factors.

Editor's Abstract.

TRACHEAL TUMORS: CONTRIBUTION TO CASUISTICS. H. BARTH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:583 (July 22) 1932.

Barth reports his recent observations of a case of recurrent tracheal tumor, which was one of three reported by Minnigerode in 1924. The original tumor, located on the posterior wall of the trachea, was resected in 1923. The first biopsy, three years previously, had given the diagnosis of endothelioma. A second biopsy a year later had resulted in a diagnosis of mixed tumor of partially endothelial and partially chondromatous character. Microscopic examination of the resected tissue confirmed the diagnosis of a mixed tumor of apparently benign nature. In 1931, seven years after the first operation, another tumor, again originating from the posterior wall of the trachea, had to be resected. A tumor mass at the point of insertion, apparently behind an intact mucosa, was also removed. In addition to this, a tumor that had developed in the soft parts of the neck at the site of the original tracheostoma was excised. This time the tumor was diagnosed as a "basalioma." At the time the author reported the case, one year after the second operation, there was a small tumor next to the tracheostoma scar, and in the subglottic region there was a protuberance of the tracheal mucosa which reduced the lumen of the trachea by almost one-half. The author thinks that this tumor, variously diagnosed as endothelioma, "basalioma" and mixed tumor, is of the same type as the mixed tumors of the parotid. Histologic preparations show the polymorphology peculiar to the latter. The tissue exhibits, in part, the typical structure of a "basalioma," and in other places the structure resembles a cylindroma and sometimes indicates an endothelial origin. The stroma, consisting chiefly of taut fibered connective tissue indistinguishable from degenerated hyaline connective tissue, as well as an extensive process of liquefaction, is also typical of mixed parotid tumors. The slow growth of the tumor is another point of similarity with mixed tumors of the parotid. The author thinks that the tumor originated from the tracheal glands and extended under the tracheal mucosa, finally breaking through it to proliferate in the tracheal lumen. The tumors in the soft part were due to a locus minoris resistentiae of the tissue; like the tracheal tumor, they were not infiltrating.

EDITOR'S ABSTRACT.

SURGICAL TREATMENT OF DISTURBING STYLOID PROCESS. W. KLESTADT, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:103 (Sept.) 1932.

The accidental luxation of the tip of an elongated styloid process, which occurred during an attempted resection of the distal portion of the process and which resulted in the disappearance of the symptoms, led Klestadt to suggest induced fracture and luxation as a surgical treatment for a disturbing styloid process. In the case reported, the author had cut around the blunt end of the tip of the process, incised the muscles or tendon sheaths surrounding the process and made a longitudinal incision through the periosteum and was preparing to resect the bone, when the tip was fractured and disappeared. If fracture is intentionally induced, the periosteum incision may be omitted, but incision of the ligaments or the tendons is necessary, for in luxation without this the fractured tip would stay in place. The dislocation of the tip laterally from the taut ligament and tendon sheaths removes it from the glossopharyngeal nerve, pressure on which causes most of the pain, and also from the mucosa, irritation of which causes disturbances in swallowing. The dislocation also should prevent recurrence by giving opportunity for a new syndesmosis or synostosis in a more favorable location; time will tell whether such is the case. Omission of the periosteum incision practically eliminates the danger of osteomyelitic or otitic infection.

EDITOR'S ABSTRACT.

DENTAL PROSTHESIS IN ORAL AND MAXILLARY SURGERY. H. SCHRÖDER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **23**:121 (Sept.) 1932.

The purpose of Schröder's article is to present the main points of a lecture given by Axhausen before the "Laryngologische Gesellschaft" of Berlin (Dec. 18, 1931) on the importance of dental prosthesis in oral and maxillary surgical procedures. He describes various types of prosthetic appliances, dividing them into three groups according to their functions. The appliances of the first group serve the same purpose as bandages or supports in general surgical methods and are used especially after surgical closure of congenital defects of the palate and also for syphilitic defects. A rubber plate, which is used after resection of the superior maxilla to hold the tampon in place and which has a support to prevent falling in of the cheeks, belongs in this group. The second group of prosthetic appliances aids in the preservation of occlusion and articulation. These appliances have proved valuable in cases of fracture of the maxilla or of osteomyelitis and, above all, in resections of the inferior maxilla, which, before the use of dental prosthesis, were usually followed by serious impairment of the functions of speech and mastication. The third group of appliances aids in the preservation of the mobility of the maxilla.

EDITOR'S ABSTRACT.

Society Transactions

GERMAN OTOLARYNGOLOGICAL SOCIETY

Bad Elms, May 12 to 14, 1932

ZEITSCHRIFT FÜR HALS-, NASEN- UND OHRENHEILKUNDE **31**:132, 1932

ABSTRACTED BY ALFRED LEWY, M.D.

THE BIOLOGIC EFFECT OF ROENTGEN AND RADIUM RAYS. DR. ENGLMANN.

The observations are based on a histopathologic diagnosis of the tumors reported and on the other (healthy) tissues studied.

After a destructive dose the changes in the tumor cells consist of vacuolation, droplet or mucoid degeneration, fatty or lime deposits in the protoplasm, with pyknotic or chromatolytic changes in the nuclei, and, rarely, amyloid changes.

The studies of the adjacent tissues were made after treatment according to the Coutard method, that is, frequently repeated small doses over a long period.

In a few cases there was a slight leukopenia, and 2 of 12 studied showed a slight increase in monocytes. Therefore there was no serious damage to the cellular elements of the blood stream.

The sebaceous and sudoriferous glands showed atrophic changes, but fewer than under the former intensive treatment.

The lymphatic tissues showed definite atrophy, but under the microscope functioning tissue with germinal centers was found, so that a permanent "sterilization" did not take place.

The secretory (parotid and submaxillary) glands showed scarring sclerosis of individual sections, with marked atrophy of the glandular tissue but preservation of the ducts. This accounts for the dryness complained of by many patients.

No changes were noted in either the cartilage or the perichondrium of the larynx. The lime content and the cellular structure of the cell islands and matrix remained normal, so that there need be no fear of late necrosis. The mucosa of the pharynx and trachea was well preserved.

The author stated that the great physiologic value of this method of irradiation probably depends on the preservation of the vessel-connective tissue apparatus and its effect on the reaction and healing processes.

THE RESULTS OF IRRADIATION OF MALIGNANT TUMORS OF THE UPPER RESPIRATORY TRACT. DR. JUNG and DR. MARTENSTEIN, Breslau.

The authors at first were limited in the use of radium, but in their later cases both roentgen therapy, supplemented by radium, and thorium-x needles were used.

Their results were tabulated as follows: Of 22 patients with tumors of the epipharynx 13.6 per cent showed healing, 9.1 per cent improvement, 22.7 per cent no change and 13.6 per cent progress of the growth, and 40.9 per cent died. In the group with tumors of the mesopharynx, there was healing in 18 per cent, improvement in 18 per cent, no change in 25 per cent, progress of the growth in 10.5 per cent and death in 25 per cent. The group with tumors of the hypopharynx and larynx showed healing in none, improvement in 27.7 per cent, no change in 16.5 per cent, progress of the growth in 33.5 per cent and death in 22.3 per cent.

The conclusions of Jung and Martenstein are that with their method roentgen therapy alone has been unsatisfactory. On the other hand, from their results with the combined use of roentgen therapy and the local application of radium this method appears as good as any other and is capable of further improvement. However, if the Coutard method proves more effective, the authors will take it up.

EXPERIENCES WITH RADIUM IN CARCINOMA OF THE UPPER AIR PASSAGES. DR. THIELEMANN.

In the Bonner Clinic a radium plaque is placed under the perichondrium of the larynx (after a median soft tissue incision), without a cartilage window. No necrosis or abscess has been seen except a small area of necrosis in one case following influenza. They believe in the single large amount of 30 unit skin doses. In one case an 18 mg. plate was inlaid for 7 x 24 hours; in another case a 15 mg. plate for 7 x 24 hours, etc. The doses amounted to from 100 to 1,800 mg. hours. Later they were reduced because of reports of necrosis of cartilage. By this technic the largest possible dose was applied directly without danger to the skin. Surgical removal is preferred in all endolaryngeal cases if not contraindicated or refused, and in the others electrocoagulation if not too widespread, always followed by irradiation because coagulation may stimulate the recurrence. Except in laryngeal cases the radium carrier is on a flexible wire attached to two teeth, and is usually left in situ twenty-four hours; first, local anesthesia is used, followed by morphine and scopolamine hydrobromide, which enable the patient to tolerate the applicator. The interior of the larynx does not tolerate it long. In carcinoma of the nose and upper jaw coagulation is performed according to Holmgren's method, followed by irradiation. The author believes that the single large dose is less dangerous than the same dose divided, so far as the eyeball and the base of the skull are concerned. Avertin rectal anesthesia is preferred; ether is explosive, and chloroform, when ignited produces phosgene. Gland metastases should be removed surgically after irradiation. Carcinoma rests have been found in such glands after thorough irradiation. In using thorium the author prefers removable needles, as the "seeds" often result in fistulas.

While the author is not too proud of the results, they show improvement. Formerly carcinomas of the hypopharynx required early gastrostomy and pursued a rapidly fatal course. During the last few years the patients have been kept fairly symptom-free for one or two years, some even pursuing their vocation, and this palliation is looked on as evidence of progress.

RESULTS OF IRRADIATING MALIGNANT GROWTH OF THE UPPER RESPIRATORY AND FOOD TRACT, WITH SPECIAL REFERENCE TO THE COUTARD METHOD. DR. HUENERMANN.

Daily doses of one-third unit skin dose, to a total of from 6,000 to 12,000 roentgens, or from 10 to 20 unit skin doses, over two or three fields and lasting three or four weeks, were given. Because facilities did not permit, instead of using from a 60 to a 100 cm. distance with a 3 mm. copper filter, one hour daily, the author used a 30 cm. distance and a 0.5 mm. copper filter for ten minutes' exposure daily. The great drawbacks to the method are the time and expense required, which are considered in detail.

The author agrees with Regaud, Suppinger and Englmann that the anepidermoid cancers are much more radiosensitive than the epidermoid types. He believes that fractional prolonged treatment is a distinct advance, but that the total dosage will have to be increased to 10 or more unit skin doses and that further investigation leading to standardization and typing of methods is desirable.

CLINICAL NOTES, PATHOLOGIC ANATOMY AND THERAPEUTICS OF MALIGNANT GROWTHS OF THE UPPER AIR AND FOOD PASSAGES. DR. RICHTER.

The statistics cover 219 of about 35,000 patients (0.626 per cent) observed in the Erlanger Clinic from 1919 to 1931. There were 72 growths of the nose, 27 of the larynx, 23 of the ear, 23 of the nasopharynx, 23 of the esophagus, 16 of the tonsils, 13 of the hypopharynx and 9 of the neck, lungs, etc. One hundred and fifty-eight cases occurred between the ages of 47 and 51. There were 156 men and 63 women; noteworthy here is the predominance of carcinoma of the larynx and esophagus in men. The occupations of the patients are also interesting, there being 132 agricultural and other manual laborers against 22 brainworkers.

In all doubtful cases of malignant growths of the esophagus esophagoscopy should be performed. A positive Wassermann reaction should not exclude a biopsy, and a positive result in biopsy should be followed promptly by an operation. Biopsy of regional glands is often valuable, and it should be remembered that tuberculous glands may be associated with adjacent malignancy. Of the growths listed 168 were carcinomas and 37 sarcomas.

The treatment consisted of surgical removal plus irradiation, or irradiation alone, or in hopeless cases, of sympatomatic treatment alone.

Arranged according to location, the statistics for groups in which there was "cure" are as follows: 1. Skin of the auricle, 9 cases. One was healed by operation. 2. Nasopharynx, 8 cases. One sarcoma was healed by irradiation. 3. Larynx, 14 cases. One was healed by combined operation and irradiation. All patients who had irradiation alone died. 4. Tonsils, 7 cases. One sarcoma was healed by operation and irradiation; 1 carcinoma by irradiation alone. 5. Skin of the outer nose, 15. Four of 6 growths were healed by combined treatment; 4 of 7 by irradiation alone. Two patients treated symptomatically died. 6. Inner nose and paranasal sinuses, 25. In a group of 16 patients receiving combined treatment, 5 of 12 carcinomas and 1 of 3 sarcomas were healed; 1 patient with a lymphoepithelioma died. In a group of 8 patients given irradiation alone, 1 of 4 carcinomas and 1 of 4 sarcomas were healed. One patient given symptomatic treatment died. The author advises frequent biopsies from the postoperative granulation tissue, in which malignant tissue may be embedded as an indication for more irradiation. He believes that in tumors of the maxillary, ethmoid or sphenoid sinus the permaxillary operation of Denker is the one of choice.

In general, the author concludes that all operable growths should be given surgical treatment, followed by irradiation. He is well impressed by the results of the Coutard technic, which has been used in the clinic for the last two years; the results are not included in the present report. However, he would not risk using irradiation alone in a definitely operable tumor, especially of the sinuses, vocal cords, tonsils and outer ear.

Radium Therapy Especially Radium Puncture in Mucous Membrane Cancer of the Upper Air and Food Passages. Dr. Luescher.

The author presents data from the Berner Clinic from 1924 to 1929 (55 cases). He thinks palliative treatment not worth while. The endeavor is made to kill epithelial tissue with the greatest possible safety to the connective tissue of the blood vessels, using small quantities of radium, heavily screened, to secure only hard rays, over a period of from three to fourteen days, so as to attain a large total dose according to the principles of Regaud. Needles in a barbed carrier ("harpoons"), which do not slip out of the tissues, but are easily removed, are recommended. Each harpoon contains 3.3 mg. of radium element and remains in situ from forty-eight to seventy-two hours. With a distance of from 1 to 2 cm. this dosage equals from 150 to 230 mg. hours, or from 1 to 17 millicuries destroyed per cubic centimeter of tissue. Great care is taken to include the tumor margins. The needles are inserted directly into the tumor mass. Contact irradiation is done with capsules of from 10 to 20 mg. of element and from 1 to 2 mm. platinum screening. Lymph gland metastases were radically removed surgically if operable, i. e., if not adherent to the underlying tissues, with resection of the jugular and occasionally of the carotid.

Two hundred and nine patients were treated. Ten are symptom-free after five years; 20, after three years. The growths are listed by location as follows: 1. Inner part of the nose, 1 case; 1 patient symptom-free. 2. Paranasal sinuses, 22 cases; 4 patients symptom-free. 3. Tongue and floor of mouth, 21 cases; 10 patients symptom-free. 4. Mouth and elsewhere, 8 cases; 4 patients symptom-free. 5. Tonsils, 14 cases; no patient symptom-free. 6. Pharynx, 20 cases; 2 patients symptom-free. 7. Introitus of larynx, 60 cases; 5 patients symptom-free. 8. Interior of larynx, 13 cases; 4 patients symptom-free. 9. Esophagus, 50 cases; 1 patient symptom-free.

Statistically the article endeavors to cover all angles. The high percentage of fatal results in tonsillar, pharyngeal and esophageal lesions or at least the failure to obtain permanent cures is notable. In one table the author compares the results of operation alone with operation plus irradiation, showing from a twofold to a threefold better result with the combined treatment. Another conclusion arrived at is that better results are obtained with distance irradiation in addition to intratumoral application of the "harpoons." Also one can do excellent work with small amounts of radium, properly used. Not more than 100 mg. of radium element was used per patient. This fact is of practical value to small medical centers not possessing large quantities of radium.

THERAPY IN MALIGNANT TUMORS OF THE EPIPHARYNX. DR. L. KRAUS, Prague, Czechoslovakia.

Previous results with older methods have been disappointing. With the last year, following the development of the Coutard method, better immediate results have been obtained. These are too recent for one to judge of the end-results. One of the reasons for poor results is the lateness of recognition of tumors of the epipharynx, as they are often symptomless locally for a long time, until metastases have taken place. It is also noticed that small tumors usually metastasize widely, while large ones may be only local. In treating tumors in the vicinity of the epipharynx their tendency to spread to the ears, nasal cavities and base of the brain must be taken into consideration. Here the roentgenogram may show the extent, posterior rhinoscopy alone being deceptive.

For each field under a 2 mm. copper and 1 mm. aluminum screen, 180 kv. in daily doses of from 300 to 400 roentgens to a total of 4,500 roentgens is applied over several fields, depending on the spread of the tumor. Irradiation of lymphatic metastases is also employed and is preferred to surgical removal, which the author believes inadequate. The reaction is severe. There is sloughing of the mucosa and even of the soft palate and uvula. The patients cannot swallow, and lose much weight; they may have to be fed by a nasal tube. Some become discouraged and discontinue treatment. There is also marked radio-epithelitis; even the corium may be exposed. This condition eventually clears up and the tumor sloughs away or is shrunken. This severe treatment, however, is the only one from which the author has seen even temporarily good results; it is still too early to speak of a permanent cure.

The author states that it is necessary for the clinician, roentgenologist and pathologist to work together in the care of these patients.

TREATMENT OF MALIGNANT TUMORS OF THE THROAT, NOSE AND EAR. DR. HESSE, Koenigsberg.

After analyzing the results of treatment of various types of tumors in different locations the author tries to relate the histologic findings and other factors to the method of treatment.

General conclusions are drawn as follows: Among the healed lesions the greater number were those with relatively fewer mitotic cells, those with a greater inflammatory reaction and those with a poorer staining quality of the nuclei. So far as connective tissue content and blood vessel supply were concerned there was no special difference. It is not advisable to undertake dangerous or deforming operations in order to achieve wide removal of sarcomas, as they are more radiosensitive. On the other hand, this may be necessary in carcinoma. How far the Coutard method will influence this conclusion it is too early to state. For the present, the author recommends surgical removal as more certain when the tumor is accessible for complete removal.

DOSAGE OF ROENTGEN RAYS IN MALIGNANT GROWTHS OF THE UPPER JAW. DR. MITTERMAIER.

In the Freiburg clinic opportunities are offered for experimenting with various methods of irradiation: 1. That employing a single maximum dose (now still used

for carcinoma of the lip and skin). 2. The saturation method, consisting of one large dose, followed by several carefully computed smaller ones. 3. The fractional method, comprising the daily similar dose and the protracted fractional dosage of Coutard, which by heavy screening permits longer exposure and a larger total dose. All the methods are at least temporarily successful in radiosensitive tumors, such as lympho-epithelioma, but in keratinized squamous epithelial growths, only the last-mentioned method causes regression, and then not completely, but with recurrence. The author believes that surgical removal by diathermy should precede irradiation, although sometimes by preliminary irradiation a tumor mass may be reduced to operable proportions.

DISCUSSION

DR. SCHINZ: Statistics of the Zurich University Clinic from the spring of 1929 to the end of 1931—during this period protracted divided doses were given according to Coutard's method—are compared with the statistics of Zuppinger for the period from 1919 to 1928, showing that the temporary results achieved by the Coutard method are far better. Statistics on the use of the Coutard method in cases of from two to nine years' duration are quoted, showing the advantages of this method.

DR. HOLFELDER: Prolonged irradiation is only one method of treatment. After two years' experience with the Coutard method I fail to see its advantages over other methods properly applied. I have returned to the divided dosage (not prolonged applications) over from four to six fields, so that each field has several days between treatments. I believe the same results are achieved. It is important that this work be done by experienced roentgenologists in close cooperation with ear, nose and throat specialists.

DR. HALBERSTADTER: Late necrosis occurs, months or a year after irradiation. The smallest dose after which I have seen it happen is 1,600 mg. hours applied during one day. I now use from 100 to 12,000 mg. hours, with a 1 mm. platinum screen, in maximum daily doses of from 75 to 150 mg. hours. My advice is not to go beyond these doses and also to keep in mind the secondary β rays.

DR. HEDFELD: The physical effect of short wavelengths leads through chemical change to a biologic effect, and through atomic destruction, according to the theory of Dessauer, it leads to a spreading up and involution of the life process of the cell, with irreparable injury to the undifferentiated radiosensitive tumor cell, but with reparable damage to the normal cell. Or perhaps the explanation lies in the observation of von Gurwitsch, that the dispersion rays have a mitogenetic effect, which may explain the morphologic changes. My observation of over 500 cases, leading either to fatal issue or to cure, has given me the idea that underlying the so-called malignant tumor is a metabolic disease in its widest sense. Against this is the resistance of the organism. If there is a weakening of this resistance at any point, that area becomes a *locus minoris resistentiae* for the tumor. It is important that the irradiation be limited to the pathologic tissue so far as possible, to avoid damage to the resistance of the normal surrounding tissue. For this reason I believe that the divided, prolonged dosage will not be as successful in, for instance, abdominal tumors, in which the rays must pass through much normal tissue. The fate of the patient depends more on the improvement of the general condition than on the disappearance of the primary tumor, so far as the danger of recidivation and metastases is concerned.

Research should be directed toward discovering the carcinomatous condition before the local manifestation appears. Such work is being done by Kreuzberg, Dannmeier, Hartleb, Lederer, Noel, Schubert, Seel and Treplin.

DR. PETZAL: One patient, in whom a lympho-epithelioma was irradiated according to the old method in 1930, is symptom-free. One in whom a similar lesion was irradiated in February, 1932, according to the Coutard method, is also symptom-free; a recent biopsy shows normal tissue only. One patient with a tonsillar carcinoma irradiated according to the Coutard method died of metastases (keratinized squamous epithelioma). One patient with a tonsillar carcinoma treated

by means of the older method of irradiation plus thorium-x needles in September, 1930, is clinically well, but a recent biopsy shows living cancer cells in the deep tissue, indicating how careful one must be about accepting the decision, "clinically healed," as satisfactory.

DR. MARSHIK: (Observations extending over twenty years were presented. Radium on flexible copper extensions attached to spectacle rims, so as to obtain elasticity, was used; for contact cases less filtration was employed, as the α and β rays are sometimes also desirable.) For distance irradiation I use 2 mm. brass to obtain only hard rays. On the basis of my experience with over 300 cases I believe in moderate divided doses, and think that the good effects of the protracted treatment lie in the repeated exposures, which should gradually be reduced in strength and the intervals lengthened. I am not convinced that it is wise to give up the use of surgery, but think that the best results are obtained by following it with irradiation, except in carcinoma of the hypopharynx which should be irradiated without an operation.

DR. VOGEL: I disagree with Richter that it is suicidal to irradiate carcinoma of the vocal cord instead of attacking it surgically. In view of excellent results he believes that radium should first be tried. An operation can be done later if necessary. On several occasions when an operation was performed following irradiation according to Coutard's method, variable reactions of the tissues were noted. Once the skin was leathery, while the muscles and connective tissue appeared normal. In another patient all the tissues were fibrosed; in a third case thick hardened degeneration of the skin and sternocleidomastoid muscle occurred, with necrosis of the thyroid cartilage and tongue musculature. Location plays a part. In one case of carcinoma of the larynx and upper part of the esophagus the laryngeal lesion disappeared without a trace, but the esophageal part progressed steadily. Tumors that are histologically identical may behave very differently, and the same is true of tumors of the same size. Age and general condition were without observable influence. A marked mucosal reaction is necessary for results. At the present time the prognosis in any given case is unsolved.

DR. BROCK: Hegener contends that after a tumor has once been irradiated unsuccessfully a second attempt cannot be carried out. I disagree with this opinion. In a case of widespread carcinoma invading the right side of the neck, filling the sinus pyriformis and pushing the head to one side, one series of treatments failed, but on second trial the growth entirely disappeared.

DR. SEIFERTH: Our clinic has been using the Coutard method for one and three-fourths years, almost entirely on inoperable tumors with glandular metastases. Some of the cases at autopsy showed healing of the original growth, death occurring from glandular metastases. I advise irradiation of the glands first and operative removal after they are smaller. Growths of the same histologic character behave very differently under treatment. One must be very careful of those with surrounding inflammatory infiltration because of subsequent necrosis. I have seen 6,000 roentgens given without the development of radio-epithelitis. At least as important in the prognosis of large tumors as the histologic character is the condition of the surrounding tissues.

DR. WESSELY: Results cannot be calculated from the number of milligram hours alone. If the various factors are changed, the results will be different. There is a limit to the amount that may be used safely within a certain period in order not to injure the surrounding tissues. After healing with normal scar formation I have seen late necroses appear. Also lesions have been noted low in the hypopharynx, which I attribute to radioactive saliva. I therefore recommend the use of atropine during the application. It is possible to improve the lumen of the esophagus even though the surrounding tumor persists. I believe that in our cases the small protracted dose method has resulted in improvement, but is largely only palliative. I believe that statistics should be standardized to speak of healing only after a five year period.

DR. BERGER: In order to protect the cartilage and other structures we use a box, 9 by 12 by 4 mm. in size and covered with 1 mm. platinum on the back

and sides, with 1 mm. brass in front; 20 mg. of radium is used to a total of from 700 to 900 mg. hours. The brass side is placed in as close contact as possible with the vocal cord. If the distance is 15 instead of 10 mm., twice the dosage must be used. In order to describe the technic intelligently the time, distance, quantity of element and filtration must be accurately described, also the size of radiating surface.

DR. MAYER: The Coutard method is today the best method for tumors of the hypopharynx, but radium is superior in many instances because of better local application. Laryngeal application is best obtained by laryngofissure, and in order to make this sufficiently wide, I also perform a posterior cricotomy. This operation may be reserved for those cases in which irradiation from the outside does not suffice.

DR. HOFER: We have been working intensively on malignant tumors of the nose since 1918, and believe that the influence of irradiation on intact tumors is small. The situation is different with primary surgical removal followed by irradiation. We have proved that very high doses of radium are tolerated in the nose, even when the dura is laid bare—as high as from 5,000 to 6,000 mg. hours. We held a whole series free from recurrence and under control for nine or ten years. These results were published but overlooked by Dr. Hegener. Tumors of the tonsillar and pharyngeal region are best irradiated, as the use of surgery is unsatisfactory. In cancer of the larynx all experience so far indicates that irradiation alone is insufficient.

DR. HALLE: In cases of tumors of the maxillary and other sinuses radical operations plus irradiation have been successful. In one case, in which a tumor of the nasopharynx was coagulated after splitting the soft palate, followed by removal of widespread gland metastases and irradiation, the patient is symptom-free after four years.

DR. CAESAR HIRSCH: Two years' experience with the Coutard method has given favorable results. Tumors of the upper jaw involving the alveolar process require total extirpation by diathermy, the Denker operation being insufficient. A prosthesis is immediately inserted, and the cosmetic result is good. Several patients are reported symptom-free after five years.

DR. LANGE: In the Gluck-Sorensen clinic, 1,100 patients have been operated on in twenty years. Of pharyngeal tumors 10 per cent were cured. All patients in whom glandular metastases are found are irradiated, but no permanent results have been obtained. Whether the Coutard method will do better is still to be seen. The disappearance of palpable glands is no criterion, as frequently we find that glands removed at operation are simply inflammatory. Endolaryngeal carcinoma can be totally extirpated. In cases of carcinoma of the vocal cords healing occurred in 90 per cent by laryngofissure; the recurrences were also sometimes healed by secondary operation. The functional result is good, but if it is not so good as that following window resection and irradiation, there is no danger of late necrosis. Our results with hemilaryngectomy show 65 per cent without recurrence and total extirpation in 30 per cent, the recurrences being mostly glandular. The statistics on irradiation are largely concerned with intrinsic carcinoma and therefore cannot be compared. Persons undergoing laryngectomy are not in a pitiable state. On the contrary, many professional and business people are pursuing their usual occupations. It is necessary to have them develop speech just as it is to furnish a prosthesis for deforming operations.

DR. ALBANUS: I consider the reaction of the mucous membrane a poor guide to dosage; the effect depends on filtration. Is it not better in cases with early cachexia first to treat the patient constitutionally before using local irradiation?

DR. HOLTHUSEN: The important thing is not the method so much as the dosage. By a protracted method I mean long-continued repetition of small doses to a large total, until a marked reaction of the mucous membrane occurs. We are not yet claiming permanent results, but results so far, compared with previous results over the same period of time, are favorable in a large number of cases.

DR. HEGENER: The majority of our patients are "used up," as well as affected with tumor, and have an average age of 60 years. If irradiation gives them two more years of comfortable living, it is worth while as compared with major surgery. Age and social conditions must also be considered. A teacher must have his speech and might prefer window resection and irradiation of the larynx. On the other hand, I consider advisable the complete resection of the maxilla, removing all bone that might interfere with irradiation.

AN UNUSUAL LATE SEQUEL OF ROENTGEN TREATMENT OF THE LARYNX. DR. K. BECK.

Six years after irradiation, dysphagia and dyspnea appeared, with gradual contraction of the larynx but without scar formation, the appearance being that of a juvenile larynx. Tracheotomy was necessary. Three years before, the skin showed characteristic ulcers and telangiectases. Roentgenograms revealed ossification of the entire framework of the larynx. The author believes that a previous syphilitic infection for which the patient was treated may have made the tissues more susceptible to injury.

ANATOMICO-PATHOLOGIC STUDY OF LATE INJURIES TO THE LARYNX BY ROENTGEN RAYS. DR. KLESTAD.

After reviewing the literature and giving in detail the treatment in his case the author concludes:

1. The reaction of the larynx to roentgen treatment does not necessarily consist of destructive changes in the cartilage and changes in the soft parts.

2. The laryngeal framework may be altogether uninjured.

3. The inner soft parts, especially the mucosa, may alone be damaged even though they are not more sensitive than other mucosal surfaces. The question of the effect on the esophagus has not been settled.

4. The late reaction of the mucosa may occur without any great damage to the blood vessels.

5. A high grade swelling of the larynx, associated with paramedian fixation of the cords and tenderness, does not necessarily mean perichondritis, at least not when the late reaction is mild.

6. Aside from the damage to the laryngeal mucosa in the case reported, with the doses used and with the best possible screening of the larynx, the generalized telangiectases, indurations, etc., in the whole front of the throat must have been caused by the indirect rays.

CLINICAL EXPERIENCE WITH RADIUM TREATMENT OF LUPUS OF THE MUCOUS MEMBRANES. DR. BERGER.

The author reports his results in seventy-nine patients, seventy of whom were treated in the last two years. Nearly all of them remained under observation. Sixty-one were females and eighteen males, from 9 to 66 years of age. Of all the methods used, including roentgen treatment, none was successful but radium therapy. At first a dose of 2,400 mg. hours was given, using 20 mg. of the element and a 1 mm. brass filter. Good healing resulted, but in some cases there was atrophy of the nasal mucosa. In several cases necrosis of the hard palate developed from three to six months later, but was eventually cured. This led to smaller dosage. Platinum boxes are now used which have a side and back measuring 1 mm. and a brass or aluminum window, 1 sq. cm. in area. This method protects all but one surface, and furnishes 50 mg. hours of irradiation per square centimeter of diseased surface by contact. With this dosage there were four instances of recidivation. The correct dose is now believed to be 70 mg. hours per square centimeter of surface. Lupus of the hard palate associated with lupus of the floor of the nose needs only a nasal application in most cases, using from 300

to 400 mg. hours. Lupus of the soft palate is treated by means of a tooth prosthesis. Electrocoagulation or freezing is preferred in lupus of the gums. The results in laryngeal lupus are not satisfactory owing to the difficulty of applying a fixed carrier. The danger of cancer after irradiation of lupus is so slight that it may be ignored.

ROENTGEN TREATMENT OF LARYNGEAL TUBERCULOSIS. DR. ZANGE.

Ten years before, the author reported on his lack of success with the roentgen treatment of laryngeal tuberculosis. He believed that success depended largely on the general condition of the patient, and he hoped to establish what he termed a "biologic dosage." Every patient now is examined thoroughly, both locally and generally, by specialists and internists with a view to determining his probable resistance and reconciling this with the local findings. Two general pictures have been identified: a stationary, mostly productive form and a progressive, mostly exudative form; there are also mixed types. Some of the progressive, exudative types of laryngeal tuberculosis are seriously injured by 10 per cent of a unit skin dose, while some of the productive types showed the best results with one unit skin dose or more. Some patients with the latter type experienced local healing, only to die of tuberculosis of the lungs. Also cases that at first appeared locally to be of the productive type, but showed the progressive type in the lungs, later revealed the progressive type of infection in the larynx. On the other hand, some cases that at first were thought to be of the exudative (ulcerative) type, but that showed good general resistance, were found to be caused by lymph congestion which produced an exudate of deceptive appearance. After these experiences no patients were treated with roentgen rays until after three weeks of observation, during which time they were given insufflations of from 2 to 10 per cent zinc diiodo *p* phenolsulphonate to control general inflammation and permit determination of the pure tuberculous disease. Even then the first dose was small and its reaction studied carefully before further treatment was given. Local treatment in connection with roentgen therapy consisted only of the use of menthol oil or zinc diiodo *p* phenolsulphonate. While cauterization, curettage and similar procedures have given beneficial results, they have also at times produced exacerbations. The author therefore considers roentgen treatment far better, and believes in giving one dose, as high as the patient's resistance permits, and then waiting for the general cure to take place. Occasionally an easily reached lesion is removed surgically.

To sum up, after twelve years' experience with three hundred and fifty cases the author concludes that roentgen treatment is superior to any other one method, but is a two-edged sword, to be used only in selected cases. The general condition and resistance must be considered; in this connection the local conditions give important indications, the productive (granulation) type of lesion being favorable for treatment, and the exudative (ulcerative) type unfavorable. The best average dose is from 30 to 50 per cent of a unit skin dose, calculated at the depth of the larynx (approximately 3 cm.), given at intervals of from four to ten weeks. Each treatment must be preceded by a careful review of the whole condition. In patients with low resistance and an exudative type of infection the doses must be very small; even 10 per cent of a unit skin dose may be dangerous. Also patients with dysphagia, in whom perichondritis may be present, must receive small doses, from 5 to 10 per cent of a unit dose; these may at least relieve the pain.

TREATMENT OF TUBERCULOSIS OF THE MUCOUS MEMBRANES BY FREEZING. DR. NUSSBAUM.

The author used a carbonic acid-acetone mixture with excellent results. Most of the series consisted of cases of tuberculosis of the mouth and pharynx, but there were enough cases of tuberculosis of the nose and larynx to justify the statement that the results of freezing in the latter condition are good. Complete healing with a smooth scar takes place in four weeks. The treatment is repeated,

as a rule, in eight days. The reaction consists of fresh granulations, surrounded by a red areola without swelling. The difficulty in laryngeal application is with vapor on introduction of the instrument. This is also true when one uses carbon dioxide snow. There is a distinct difference between the effects of burning and freezing on tissue. In burning, the tissues are carbonized. In freezing, the cells are not immediately destroyed, but preserve their texture as in frozen microscopic sections. By freezing is meant the formation of ice in the tissue. Rapid lowering of temperature kills more quickly than gradual reduction. Schade is quoted on the results of freezing: 1. There is colloidal chemical injury in the sense of jelling. 2. Osmotic injury occurs, owing to moisture changes in thawing. The coarse crystals formed in freezing tear the protoplasm. In rapid freezing the crystals are larger and do more damage. 3. There are ischemic changes through vessel spasm. Prolonged injury is due to subsequent stasis, thrombus formation and closure of vessels as a result of endarteritis. This is of the greatest importance.

In diseased tissue a different course seems to ensue. In tuberculous tissue no defect is left; granulation tissue fills the ulcerated area to a smooth scar. The author is unable to explain the especially favorable effect in tuberculosis. It must be due to a tissue reaction, as the bacteria are able to resist the cold. In leprosy treated by this method it was observed that tubercles far removed from the area treated disappeared; in fact, complete cures were observed. The author believes that in tuberculosis the general condition is improved by the local treatment. He has not yet experimented on tumors. (The acetone-carbonic acid mixture is not described in detail.)

TUBERCULOSIS OF THE UPPER RESPIRATORY PASSAGES: OBSERVATIONS AT SELTERSBERG. DR. BRUEGGEMANN.

The institute was opened two years ago, and is devoted especially to the treatment of tuberculosis of the larynx. Of course, the pulmonary condition also requires treatment. Two hundred and forty-three patients were treated. According to the author's experience, laryngeal tuberculosis which tends to progress in the presence of a mild pulmonary tuberculosis is a dangerous illness. In most cases the prognosis is the same for both the larynx and the lungs, but it frequently happens that the larynx heals with progressive involvement of the lungs and vice versa. The laryngeal lesion may develop at any stage of the pulmonary involvement.

Two remedies that have not yet been used are carbon dioxide and a satisfactory anesthetic for dysphagia due to ulceration.

DISCUSSION

DR. WESSELY: A case of tuberculosis showed infiltration of the lateral walls of the pharynx from the base of the skull to the pyriform sinuses; the pulmonary infection was latent. The infiltration has gradually subsided in two years under irradiation, but is not entirely gone. In laryngeal tuberculosis of the infiltrative type the dosage is one-tenth unit skin dose in two fields at an interval of from four to six weeks over a period of many months. In addition to other procedures to determine whether or not local irradiation is safe, the Fåhraeus test as modified by Westergren and Poindecker is used; 25 mm. in forty-five minutes is the limit at which cicatrization is to be expected. The sedimentation test at intervals of a few weeks is of considerable prognostic import.

DR. CEMACH: The greatest drawback to irradiation is the inability to foretell the reaction of the tissues to a given dosage. This is not the case with heliotherapy. (Zange's own statement concerning the aggravation of symptoms was quoted.)

DR. HOFER: The freezing method is applicable merely to surface lesions, not to deeper infiltrations. It will be far more helpful when it can be used for a deep effect.

DR. ALBANUS: The immunobiologic status is of the greatest importance, hence the usefulness of the carbon arc lamp over the entire surface of the body and not

locally. In a case of hereditary syphilis, uninfluenced by the usual methods of treatment, there was necrosis of the frontal septum with meningeal irritation but a negative Wassermann reaction. After heliotherapy the Wassermann reaction was 4 plus, and following renewed antisyphilitic treatment normal healing took place.

DR. BLEGVAD: The *Linksverschiebung* (shift to the left) and the sedimentation test are expressions of an infectious process, and as such are influenced much more by the pulmonary than by the laryngeal condition. Therefore I have no confidence in them from a prognostic standpoint in judging the condition of the larynx. Heliotherapy, especially use of the Finsen light, is advisable. Irradiation of the entire body with Finsen light may be dangerous for persons who are severely ill; they receive, instead, treatment with ultraviolet rays from the mercury vapor arc in quartz. In tuberculosis of the lips, tongue, pharynx and cheeks the entire area is infiltrated with a solution of sodium auro-thiosulphate. Two or three injections usually bring about healing.

DR. BERBERICH: The blood picture is of importance in judging the immunobiologic status, and the allergic situation as understood by pathologists is likewise important. Control by means of metallic salts is of great value.

DR. BRUEGGEMANN: I have used carbon dioxide snow by cutting a small piece of it and applying it intralaryngeally with a Moritz-Schmidt forceps. I believe that roentgen rays act as a stimulant in the larynx, and I therefore use small doses. The shift to the left and leukopenia are of unfavorable prognostic import in laryngeal tuberculosis. The sedimentation test indicates the condition of the lungs rather than that of the larynx.

TREATMENT OF CHRONIC DRY PHARYNGITIS WITH BORDERLINE RAYS. DR. KRAINZ.

Dry pharyngitis is often a stubborn disease. It may exist independent of similar change elsewhere. The pathology is essentially that of a subepithelial inflammation with infiltration of the epithelial tissue by leukocytes and round cells, separation of the superficial layers and edema and pyknosis of the cells. The glands show little change. The treatment consists of the application of rays of relatively long wavelength, near the ultraviolet rays; these are absorbed by the epithelium. With 2,000 roentgens no unfavorable reactions, early or late, were observed. The rays are ordinarily absorbed by the glass of the tube. A water-cooled soft tube is used, with a window of light atomic glass (Lindemann window) and a hard rubber tube which raises the soft palate while the tongue is depressed. The rays are directed to the nasopharynx for from one and a half to two minutes, in the following dosage: 12 kv., maximum; 10 ma., distance, 15 cm.; "hardness" of rays, 0.021 mm. of aluminum; single dose, from 300 to 400 roentgens. The patient's face and the hands of the physician are covered with leaded rubber. Treatments are repeated in three weeks if no improvement is seen. Two or three applications, occasionally four, are given.

EXPERIMENTAL PRODUCTION OF TUMORS OF THE EAR, NOSE, ACCESSORY SINUSES AND PAROTID GLAND. DR. BERBERICH.

In a large number of autopsies the incidence of tumors of the ear, nose, accessory sinuses and parotid gland was about 1.15 per cent. The author undertook to produce tumors by painting with tar; he used principally Japanese dancing mice, which have a congenital deformity of the ear, an anomaly which has nothing to do with embryonal misplacement. Rabbits, guinea-pigs and rats were also used. Ordinarily cholesteatoma was produced in the ears, but in a few cases papillomatous growths of the squamous epithelium occurred, penetrating the surrounding tissues like true carcinoma. The tumors could not be regularly induced, and it was more difficult to grow them in the locations mentioned than in others, which again is similar to the spontaneous occurrence of carcinoma.

WATER RETENTION AND DISEASES OF THE EAR. DR. MYGIND.

Experiments on patients with the Ménière symptom complex in whom the intake and output of fluid were measured and who were regularly weighed showed retention. Limitation of the water intake, combined with diuresis and diaphoresis, brought about definite improvement, although one case required, in addition, thyroid medication and dieting. Measurements of blood volume with Allen's hematocrit showed that in normal subjects hydremia could not be increased above 10 per cent, while in patients with Ménière's disease, especially syphilitic patients, it measured as high as 30 per cent.

THE DEPENDENCE OF HEARING ON WATER METABOLISM: RESULTS OF EXPERIMENTS. DR. DEDERDING.

A series of experiments over a period of six years have shown that one can definitely produce a marked improvement in hearing by administering a mercurial diuretic to bring about diuresis and loss of weight. If, however, patients are allowed to drink much water at the same time, improvement in hearing does not occur. Mrs. Dederding undertook the opposite experiment, viz., to have the patients drink themselves deaf; ninety-seven experiments were performed on sixty-four ears of thirty-five patients with the Ménière symptom complex. In seventy-seven experiments the hearing was diminished. It decreased with hydremia and improved with concentration of the blood. The vestibular reactions were tested in thirty patients. In nine, spontaneous nystagmus developed, and several others complained of vertigo, unsteadiness, headache and pressure in the ear. Five cases of otosclerosis or ankylosis of the stapes following suppuration showed no effect from hydremia. Evidently a movable stapes is necessary for the success of this experiment.

DISCUSSION

DR. UNTERBERGER: I used 20 cc. of 50 per cent dextrose solution intravenously once daily for eight or ten days with good results in the Ménière complex. Probably the result was due to the extraction of water from the tissues.

DR. MYGIND: My treatment consists of a salt-poor, dry diet, of stimulation of blood vessel function by means of irradiation, especially with Finsen light, and of massage, exercise and fresh air. It is important to determine in each case the exciting factor if possible.

SOUND CONDUCTION THROUGH THE CRANIUM. DR. RUF.

In contrast to the subjective methods, i. e., the Schwabach, Weber and Rinne tests, the author undertook the objective measurement of the transmission of sound through the cranial bones. Kessel and Politzer tried to do this by having a second person perform auscultation. Frey improved on this by using a carbon particle microphone. The author shows that this type of microphone begins at 200 Hertz, is not activated by weak tones and does not give the same relative values at all frequencies. For the proper measurement of sound the apparatus must have the following qualifications: Its frequency characteristic must be even; it must register energy proportional to the intensity of the sound; it should not distort the original sound by any resonance action; the fundamental tone of the instrument must be as high as possible, and damping must be good. The author finally decided on an electromagnetic microphone of the type advocated by Sell. This instrument was devised for heart and lung sounds, is very sensitive, does not distort and, with a gradual increase in frequency, is resonance-free. The electromotive force is transmitted to an oscillograph and visualized by photography.

The two places on the skull showing the greatest magnitude of sound are at the point of contact of the audiometer receiver and the point diametrically opposite. The intervening field shows a gradually diminishing force. The audiometer is preferred because of the absence of overtones, the ability to sustain amplitude and also the ability to measure from that standpoint the intensity of tone. How-

ever, to follow up previous tests, the author began with Bezold forks, using 24, 36, 54, 86, 217 and 435 Hertz. The principal locations used were: both mastoids (the fork on one and the microphone on the other); the temple (fork) and the back of the head (microphone); the frontal midline at the hair line and the occipital protuberance. The greatest transmission takes place through the bony pyramids, and the author believes that it follows the line of the greatest bone construction. It also appears that the decrement is greater the higher the frequency is above the fundamental tone of the skull itself.

THE CLINICAL SIGNIFICANCE OF THE EAR MUSCLES. DR. KOBRAK.

The latest teaching of physiology is that the muscles of the ears are rudimentary and without active function. The author disputes this idea. The first problem that he investigated was whether or not a definite cochlear reflex is exhibited by the tensor tympani and stapedius, dependent on cochlear stimulation. A second problem was whether or not pathologic conditions of these muscles have any influence on aural function. The practical value of this study is illustrated by the following case: A 10 year old boy, referred to a school for the deaf, underwent a radical mastoid operation. In this case it was possible to watch the stapes and its muscle. Muscular contractions were seen to follow stimulation by tones in the c 3 octave, indicating that vocal education could be carried out. The number of patients in whom this visibility is present is small. The author therefore endeavored to find a fluid of proper refractive index to make the membrana tympani transparent. To establish a volume elasticity coefficient of the displacement of the membrana tympani, he used an olive with a glass tube, to which a capillary glass tube was attached. The canal and glass attachment were filled with water and the movement of water in the capillary tube under known pressure read. The relation of the pressure and the displacement volume was used as a coefficient. Nicotine was injected into the opened otic capsule of rabbits, which are susceptible to this drug. It caused a prolonged contracture of the ear muscles, which could be measured in terms of the coefficient. The author believes that this test may be applied to human beings to differentiate between otosclerosis and muscular anomalies which may be susceptible of treatment (tenotomy?), heretofore on an insecure basis.

AN UNUSUAL OBSERVATION DURING THE CALORIC TEST. DR. HAYMANN.

The author reports three cases of the Ménière symptom complex in which, on the use of hot irrigations, instead of the usual horizontal rotatory nystagmus toward the irrigated side, the patient showed a horizontal rotatory nystagmus toward the opposite side. He states that no similar observations have been reported in the literature, and he thinks that this is perhaps because hot irrigation is not a routine measure.

THE POINTING TEST. DR. KOEROESI.

The clinical value of the pointing test is questionable. In the first place, the anatomic tracts over which the impulses pass are not definitely known. In the second place, psychic influences on haptokinetic memory may disturb the reaction, as may physical influences, such as the chilling of one forearm. The author believes in the theory that the reaction is produced through the cortex or subcortex, through a complicated mechanism, that it is easily influenced by extracerebellar factors, and that it is therefore not of great clinical value.

TREATMENT OF DEAFNESS WITH ROENTGEN RAYS. DR. FRENZEL and DR. SCHEIFF.

The authors quote Voss, Hamm and Diesbacher as having had favorable results with vibrations of from 10,000 to 500,000 Hertz on a Muelwert apparatus. Cases of otosclerosis, chronic adhesive processes and radical operations on the mastoids before and after treatment were shown. The authors conclude that definite improvement in hearing is questionable.

EXPERIENCES WITH ROENTGEN RAYS. DR. F. REUTER.

The author reports thirty-five cases: disease of the inner ear, nine cases; disease of the middle ear, nine; combined forms, thirteen, and tinnitus, four. Twenty-three showed improvement under treatment with the Muelwert apparatus. The author concludes that this method can produce results when other well known methods have failed.

DISCUSSION

DR. HEGENER: Two recent mechanical contrivances—an electrically driven tuning fork and the otothermy apparatus—according to general report, especially in the newspapers, are doing marvelous things in the cure of deafness. The inventor of the Muelwert apparatus now recommends from 10,000 to 20,000 Hertz, which lie within the hearing range. These same frequencies can be obtained at much less expense by using a Galton whistle, which has greater energy, is attached near the ear by a headband, is operated by compressed air, with the intermediation of a mercury manometer, and is definitely calibrated for frequency. If there is any therapeutic value in the use of the Muelwert apparatus it is through hyperemia induced by the transmutation of vibrations into heat.

CLINICAL COURSE AND PATHOLOGIC CHANGES OF OTITIS MEDIA ACUTA FIBRINOSA. DR. H. NEUMANN.

The course of acute otitis is influenced by the character of the mucosa, the architecture of the cell system, the method and nature of infection and the constitution of the patient. Classifications are difficult on any basis, but the most practical is the clinical course. The so-called typical mucosus-capsulatus course may be caused by streptococci, and may not occur at all in mucosus infections (pneumococcus type 3). The author describes a type of infection which occurs mostly in children, with much pain and a high fever, persisting after paracentesis, with a fibrinous rather than a purulent discharge, i. e., one containing much fibrin and few cellular elements; this forms plugs in the paracentesis opening and recurs after removal, or the opening gapes. The membrani tympani may not show a great inflammatory reaction. As against about 10 per cent of all patients with otitis media, 70 per cent of this group underwent mastoidectomy, and in twenty-eight cases there were two deaths, one from sepsis and one from meningitis with sepsis. Histopathologic sections of mucosa with a fibrinous exudate and little cellular infiltration were shown. Neumann believes that something inherent in the nature of the mucosa causes this type of exudate. The cases in which no operation was performed showed severe residual deafness, and most of the cases occurred in children with a history of frequent infections of the ear. In some of the cases with prolonged high fever the question arose whether they were primarily otitic or cases of general sepsis.

THE POSITION OF OTOSCLEROSIS IN MODERN PATHOLOGIC STUDIES OF THE BONES. DR. NAGER and DR. M. MEYER.

Through the comparison of hematoxylin-eosin staining with the silver impregnation method and with polarized light it has been possible to obtain more detailed information concerning the structure of bone. From these methods it has appeared that histologically there is much in common between otosclerosis and osteitis fibrosa (von Recklinghausen) and osteitis deformans in that the fundamental process appears the same, and the appearances in well developed cases are alike and permit the inclusion of otosclerosis in the bone dystrophies. However, osteitis deformans and fibrosa attack mainly the periosteal parts, while otosclerosis shows itself first at typical sites, the otosclerotic angle, round window and meatus auditorius internus in small areas, while other diseases at the periosteal margin are more diffuse and advance concentrically toward the endochondral portions. Then there is also the very slow progress of otosclerosis, the "time element."

Experimentally, changes in the bones have been produced by a calcium-poor and vitamin D-free diet, the injection of powdered epithelial bodies, chronic lead poisoning, injection of parathyroid extract-Collip, long-standing acidosis, etc. The authors conclude that these diseases are alike histologically, but differ clinically, in localization and in rapidity of course, and that further investigation of the etiologic factors is needed, especially a more detailed study of the metabolism.

DEGENERATIVE CHANGES IN OTOSCLEROSIS. DR. GRAHE and DR. GRIEBEL.

The authors claim to have shown that in otosclerosis the chemical changes in the bony labyrinth are different from those in the rest of the temporal bone in that there is greater loss of calcium. They now assert that there is a similar reaction in regard to phosphoric acid. Further investigations seem to show that normal labyrinthine bone is attacked by the blood of otosclerotic patients in greater degree than by normal blood. The authors state that otosclerosis is therefore a general disease specifically attacking the bony labyrinth, and that in no other disease have they been able to find a similar chemical change. They reject the idea that there is a change in proteins, and adhere to the idea that the attacking body is a ferment on the order of a phosphatase.

PATHOLOGY OF MENINGOCOCCIC LABYRINTHITIS. DR. VERMES.

The author gives a detailed description of a case of meningococcic labyrinthitis, with many excellent illustrations of the histopathologic changes. The paper does not lend itself to abstracting.

CLINICAL NOTES AND PATHOLOGIC STUDY OF A DURA ENDOTHELIOMA OF THE TEMPORAL BONE. DR. EISINGER.

This paper is also unsuitable for abstracting.

STREPTOCOCCUS MUCOSUS AS THE CAUSE OF SUPPURATION OF BOTH THE MAXILLARY ANTRUM AND THE MIDDLE EAR. DR. TOBECK.

The author reports that of twelve patients with mastoiditis due to Streptococcus mucosus who were operated on in the clinic during the past year, eight were found to have the same infection in the maxillary sinuses; in the latter region, however, there were no manifest symptoms, the infection being discovered by careful search and confirmed by irrigation. This is contrary to the opinion of Eckert-Möbius and others, who state that this infection occurs in the middle ear in otherwise healthy persons.

ROENTGENOGRAMS OF THE SPHENOID SINUSES. DR. LANGENBECK.

The casette on which the patient places his chin slants downward and forward. The head is extended in this direction, and the rays pass through from the anterior part of the vertex in the plane of the face. A Bucky diaphragm is employed, and by applying a sliding lead plate both views of a stereoroentgenogram may be obtained on one film, half of the film being used for each. The tube is moved back in the sagittal plane and the casette adjusted accordingly for the second view. One of the drawbacks is the difficulty that some older patients have in getting sufficient extension for the submental film position. The interpretation of the roentgenograms is discussed at length.

EXPERIMENTAL INVESTIGATION OF THE FUNCTION OF THE TURBINATE BODIES. DR. UNTERBERGER.

The author quotes Sternberg's observations on the turbinates after laryngectomy and confirms his statement concerning the absence of nasal respiration. He adds that the same changes take place even when the patient does not use mouth breath-

ing entirely. He tested the effect on the conchae of cold and hot air, both dry and moist, and of oxygen and carbon dioxide. The inhalation of oxygen for one minute caused the conchae to swell and become bright red. Three or four breaths of carbon dioxide produced shrinking and pallor. In ozena and polyposis, and to some degree in vasomotor rhinitis and chronic congestion, the usual respiratory responses to heat, cold and moisture, as shown by fluctuation of the conchae, were lacking.

Anatomic Demonstration of Diseases of the Upper Respiratory Tract, Especially the Epipharynx. Dr. Graeff.

After careful removal of the soft parts concerned, en masse, which takes ten minutes with the author's technic (not described in this article), they are sectioned coronally, to display a forward and a backward view; the laryngotrachea can then be split sagittally. The illustrations indicate a free view of, and access to, the desired area. The following may be observed: the anatomy, pathologic changes and development of the epipharynx and of Waldeyer's ring; the pathogenic relation of the epipharynx to its surroundings; the spread of disease from this region via the lymphatics, glands, veins, etc., and its relation to general diseases; the effect of general diseases on the upper respiratory passages.

One observation made is that in childhood the epipharynx is of far greater significance than the faucial tonsils.

Diathermic Treatment of Vasomotor Rhinitis. Dr. Tamari.

The author uses a single needle, about 5 cm. in length, for insertion into the turbinate. The indifferent electrode is 30 by 40 cm., and the patient sits on it without disrobing. About 500 milliamperes is used, and with this current neither the patient nor his clothing suffers ill effects. If the turbinates are congested, 20 per cent cocaine is used for anesthesia, which is adequate in two minutes. If the turbinate is not congested, alypin, 20 per cent, is used, which produces anesthesia in five minutes. The swelling is desirable, as it prevents injury to the bone. This treatment requires no special anesthesia. The mucosa remains intact, and there is no bleeding or danger of synechiae. The submucous scar develops gradually, and the result is quite permanent. In two hundred or more patients no recurrences have taken place during the first year following treatment.

Conservative Diathermy in Otorhinolaryngology and Associated Diseases. Dr. Schaefer.

The author sums up his experience with medical diathermy in one hundred and four cases as follows: Good results were observed in otitis externa, chronic catarrh of the middle ear, chronic otitis media, ozena, chronic tonsillitis and laryngitis and thyrotoxicosis. With otosclerosis and chronic inner ear deafness only relatively favorable results were achieved. Patients with diseases of the nose and accessory sinuses obtained little or no benefit.

Improved Antroscope. Dr. Luedecke.

The antrum is entered with a trocar and cannula, irrigated thoroughly and then inspected by means of the antroscope, which is inserted through the cannula. The author claims that one may thus obtain much valuable information after becoming familiar with the appearance of the antrum and with the effects of treatment with heat, irradiation, etc. The article is well illustrated.

Tissue Cultures in a Physiologic Study of the Tonsils. Dr. Greifenstein.

The object of this investigation was to determine if any evidence could be found in support of the idea that tonsillar tissue produces an internal secretion.

In the study of explants of tonsillar tissue in vitro the practically universal infection has always been a handicap, and the manipulations necessary to get rid of this difficulty may nullify the tests. Attempts were made to promote or inhibit growth in bits of tissue by provocative contact with tonsillar extract. Another method tried and abandoned was that of cultivating tissue that had been in contact with a tonsil preparation in animal plasma. A third method was to cut up tonsillar tissue finely, squeeze it in Ringer's solution, 1 cc. to 1 Gm. of the tissue, centrifugate it at high speed and filter it through a Seitz asbestos filter. As controls other tissues, such as the spleen and lymph nodes, were used. It was determined that protein substances in colloidal solution were filtrable. Coverglass cultures of fibroblasts from embryonal chicken hearts were used as test tissue. For nourishment a medium of plasma of rabbits with an anticoagulant from dog liver to which embryonal extract had been added was used. Under exactly similar conditions, freshly prepared filtrates of human tonsils and calves' tonsils, lymph nodes and spleens were used, and daily observations were made of the area of growth. There was a marked difference in the results with fresh and with old filtrates of human tonsils. The fibroblasts stimulated by filtrates of calves' tissues were of plumper outline and showed greater vacuolation and larger fat droplets than those stimulated by human extract. Also old but not inactive human extract brought about a metamorphosis of fibroblasts into macrophage-like cells. Attempts to produce polarity in growth by provocative insertions of capillary tubes containing extracts yielded inconclusive results. The stimulating elements in these extracts are believed to be substances called *Trephonen*. The article is illustrated by graphs and photomicrographs.

LIGATURE OF VESSELS WITH ONE HAND BY MEANS OF ROEDER'S SLIP-KNOT. DR. TONNDORF.

The knot looks like a lasso or hangman's knot, and is carried through an instrument like a tonsil snare. The author claims that the knot can be carried over the hemostat and tied without any pull on the hemostat. Ligatures of catgut with the knot already tied may be prepared and sterilized in envelopes beforehead.

OSSEOUS METASTASES IN POSTANGINAL SEPSIS. DR. CLAUS.

Among one hundred and twenty severe cases the author has seen five of osseous metastases: In two the hip joint was affected, and in one a vertebra; one was a case of osteomyelitis of the pelvis and one a case of spondylitis, with the patient still under treatment. None of the five patients had had angina before. The patients with the vertebral and pelvic metastases and one of those with metastases to the hip joint died. In one case the metastasis to the hip joint healed after resection of the head of the femur. The case of spondylitis occurred after tonsillitis without severe sepsis; the patient showed improvement after tonsillectomy and is still under treatment.

THE RÔLE OF SENSORY DISTURBANCES OF THE LARYNX IN THE OCCURRENCE OF THE ADAMS-STOKES SYMPTOM COMPLEX. DR. REINIGER.

In the literature of the last few years there have been a number of references to a reflex action on the heart function from irritation of various organs, such as the stomach and intestine, definitely attributed to certain nerves. Investigations by modern methods relating to the larynx, however, have been few and not so definite as the present one. The Adams-Stokes syndrome, consisting of marked slowing of the heart action with temporary cessation, was long attributed to a vagal influence, and on the authority of Charcot, was believed to be central in origin until the demonstration of the conduction system of the heart and the evidence of the electrocardiograph threw more light on the subject. Twelve days before entrance to the clinic, a 63 year old man, formerly healthy, experienced pain in the left side of the throat on swallowing cold drinks. The following day

the pain appeared also after warm drinks, and lasted two minutes. On the day of admission the patient suddenly felt a severe pain and fell unconscious. He recovered, worked two hours and then had three attacks. Examination in the clinic revealed only a slight hypertonia, myocardial changes and a minimal amount of emphysema. There were frequent attacks at intervals of from five to eight minutes, and of about that duration, produced by every attempt to swallow anything, even saliva. The patient grasped the left side of his throat; in ten seconds neither pulse nor heart beat could be detected, and he became unconscious. Then the heart beat returned, one beat occurring every five seconds; the pulse became perceptible, and in half a minute was back to normal. Inspection of the larynx, roentgen examination of the esophagus and larynx and a Wassermann test gave negative results. There was no history of an excessive use of alcohol or tobacco. The electrocardiogram indicated Adams-Stokes disease of the sino-auricular block type; i. e., there were myocardial damage, left preponderance and no conduction from the sinus node to the auricle. The longest period of ventricular inaction observed was six minutes. (A detailed description of the heart action is given and several graphs are presented.) As repeated examinations of the larynx by several physicians gave negative results, and as the pain emanated from the larynx and radiated to the ear, the condition was thought to be disease of the superior laryngeal nerve. Instead of giving the previous therapy of atropine, ephedrine and epinephrine, the larynx was cocainized, whereupon the patient was able to drink a large quantity of much needed fluid. He remained free from attacks for five hours. Then applications to the pyriform sinus had a good effect. Two days later light pressure on the spot where the nerve perforates the hyothyroid membrane brought on an attack. Although the patient already showed improvement, 80 per cent alcohol was injected into the nerve. The attacks became infrequent, and after a few days ceased entirely.

The author cites a number of cases from the literature which may have had a laryngeal basis, but in which this was not so clearly demonstrated as in the case reported. He mentions in particular the possible influence of the sinus caroticus on such attacks and of foreign bodies in the larynx, and he describes the unconsciousness produced by sudden constriction of the neck, as in hanging, as well as many other reflexes of the neck. He also discusses ictus laryngis, which is described as a sudden tickling in the larynx with spasmodic cough and a short period of unconsciousness. He disputes the theory that this is epilepsy with a laryngeal aura, as it can be cured by injections of alcohol into the superior laryngeal nerve. He also describes a case of tachycardia induced by swallowing and cured by digitalis and quinidine. He considers the tachycardia evidence of a paradoxical effect on the vagus. He thinks that laryngologists should be awake to this new field of investigation, and that in addition to the usual examination one should make tests of the tactile, pain and temperature sense of the laryngeal mucosa.

PROLONGED ANESTHESIA IN LARYNGEAL DYSPHAGIA; INJECTIONS OF ALCOHOL INTO THE GLOSSOPHARYNGEAL NERVE. DR. MATHE.

Injections of alcohol into the superior laryngeal nerve, and even section, do not always produce analgesia. This is especially true when the anterior surface of the epiglottis is involved, as this area is supplied by the glossopharyngeal nerve. The nerve emerges from the skull with the vagus and accessorius at the jugular foramen, proceeds along the inner surface of the stylopharyngeus, lying medial to the internal jugular vein, and goes between the internal and external carotids to the side-wall of the pharynx. At the insertion of the stylopharyngeus it turns forward along the styloglossus and breaks up into: (1) the ramus tympanicus; (2) the rami linguales, which supply the root of the tongue, the lingual follicles and papillae and the anterior surface of the epiglottis; (3) the rami pharyngei, which, together with branches of the vagus and sympathic, serve the pharyngeal mucosa, and (4) the rami tonsillares, serving the tonsil. From this it appears that patients with lesions of the base of the tongue, pharynx and tonsils may also be relieved

of pain. A needle, 6 cm. long is inserted between the ramus of the mandible and the mastoid process, 1 cm. above the tip of the mastoid. The needle lies horizontally and a little forward, in contact with the mastoid. The nerve is reached at a depth of 4 cm. On careful back and forth movement of the needle, pain is felt in the larynx, radiating to the ear. Four cubic centimeters of procaine hydrochloride is injected, and if the pain is relieved, 4 cc. of 85 per cent alcohol is injected. The author successfully treated four patients, some of whom required two injections. Some complained of burning pain at the site of puncture, and were given morphine for this discomfort, which was short-lived. No ill effects were noted. The author states, however, that if the vagus is blocked, recurrent paralysis produced by putting the cords at rest, would be of benefit in laryngeal tuberculosis.

OPERATION FOR FACIAL PARALYSIS. DR. HALLE.

The author has devised an operation which is a combination of anastomosis of the muscles and face lifting. Fibers of the temporalis muscle are attached to the orbicularis palpebrarum, and from the masseter to the orbicularis oris. An incision is made in the skin along the border of the lower lid and another closely parallel to it, and the intervening skin is removed; a crescent-shaped area of skin is excised at the nasolabial fold; an incision is made, beginning above the auricle in front and closely following its outline around behind it, where a V-shaped area is excised; another incision is made 1 cm. in front of this, the intervening skin being excised. Through these incisions the transplants of the muscles are carried through subfascial tunnels and sutured in place. Suturing the openings in the skin, which are made to suit the individual patient, restores the proper contour of the corner of the mouth and the eyelid. The face is held overcorrected by adhesive tape for a few days, and a pressure bandage prevents small hematomas. The operation may be combined with anastomosis of the nerves in appropriate cases.

Book Reviews

Cancer de la langue. By Pierre Sebileau. Price, 75 francs. Pp. 231, with 53 illustrations. Paris: Gaston Doin & Cie, 1932.

This book is a comprehensive treatise on cancer of the tongue, prepared in the manner which the French employ so successfully. It begins with a chapter on anatomy, followed by a historical account of cancer in this region, with chapters on the etiology, pathologic anatomy, clinical development, diagnosis, prognosis and treatment. The author has for many years been professor in the University of Paris and has had an extensive background of clinical experience.

Directory of Otolaryngologic Societies *

INTERNATIONAL

Second International Otolaryngological Congress

President: Prof. Dr. A. G. Tapia, Hermosilla, 2, Mod, Madrid, Spain.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde, Heereweg 143, Gronigen, Holland.

FOREIGN

New Zealand British Medical Association, Ear, Nose and Throat Section

Chairman: Dr. James Hardie Neil, Auckland.
Secretary: Dr. W. Gillies Borrie, Auckland.

Royal Society of Medicine, Section of Laryngology

President: Dr. E. Musgrave Woodman, 22, Newhall St., Birmingham, England.
Secretary: Dr. A. Lowndes Yates, 33 Weymouth St., W. 1, London.
Place: London. Time: May 5, 1933.

Royal Society of Medicine, Section of Otology

President: Dr. J. F. O'Malley, 6, Upper Wimpole St., W. 1, London.
Secretary: Dr. C. Gill Carey, 106, Harley St., W. 1, London.

NATIONAL

American Medical Association, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Harris P. Mosher, 828 Beacon St., Boston.
Secretary: Dr. John J. Shea, 1018 Madison Ave., Memphis, Tenn.
Place: Milwaukee. Time: June 12-16, 1933.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. B. R. Shurley, 62 W. Adams Ave., Detroit.
President-Elect: Dr. J. M. Wheeler, 30 W. 59th St., New York.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Boston. Time: Sept. 18-22, 1933.

American Bronchoscopic Society

President: Dr. Richmond McKinney, 899 Madison Ave., Memphis, Tenn.
Secretary: Dr. Edwin McGinnis, 104 S. Michigan Ave., Chicago.

American Laryngological Association

Acting President: Dr. Gordon Berry, 36 Pleasant St., Worcester, Mass.
Secretary: Dr. George M. Coates, 1721 Pine St., Philadelphia.
Place: Washington, D. C. Time: May 8-10, 1933.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

American Laryngological, Rhinological and Otological Society

President: Dr. Joseph C. Beck, 185 N. Wabash Ave., Chicago.
Secretary: Dr. R. L. Loughran, 33 E. Sixty-Third St., New York.
Place: Chicago. Time: June 8-10, 1933.

American Otological Society

President: Dr. George L. Tobey, Jr., 270 Commonwealth Ave., Boston.
Secretary: Dr. Thomas J. Harris, 104 E. Fortieth St., New York.
Place: Washington, D. C. Time: May 2-3, 1933.

SECTIONAL

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. R. H. Seeley, 9 Court St., Rutland, Vt.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Time: Third Wednesday of October, November, March, April, May and June.

New England Otological and Laryngological Society

President: Dr. Henry A. Barnes, 520 Commonwealth Ave., Boston.
Secretary-Treasurer: Dr. Lyman G. Richards, 319 Longwood Ave., Boston.

Pacific Coast Oto-Ophthalmological Society

President: Dr. Hans Barkan, 490 Post St., San Francisco.
Secretary-Treasurer: Dr. Frederick C. Cordes, 384 Post St., San Francisco.
Place: San Francisco. Time: June 28-30, 1933.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. R. Secoy, 1802 Hewitt Ave., Everett, Wash.
Secretary-Treasurer: Dr. Francis A. Brugman, 806 Cobb Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

Saginaw Valley Academy of Ophthalmology and Otolaryngology

President: Dr. R. B. Smith, Alma, Mich.
Secretary-Treasurer: Dr. W. K. Slack, 308 Eddy Bldg., Saginaw, Mich.
Place: Saginaw, Mich., or Bay City, Mich. Time: First Friday of each month except July and August.

Sioux Valley Eye and Ear Academy

President: Dr. John B. Gregg, 101 S. Main Ave., Sioux Falls, S. D.
Secretary-Treasurer: Dr. Frederick H. Roost, 420 Trimble Bldg., Sioux City, Iowa.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. W. D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Secretary: Dr. W. A. Wagner, 200 Carondelet St., New Orleans.

Southwestern Michigan Triological Society

President: Dr. Carl Snapp, 604 Medical Arts Bldg., Grand Rapids, Mich.
Secretary: Dr. Lee O. Grant, 420 Medical Arts Bldg., Grand Rapids, Mich.
Time: Third Thursday of alternate months.

STATE

Colorado Oto-Laryngological Society

President: Dr. Harry L. Whitaker, 1612 Fremont St., Denver.
Secretary: Dr. Rex L. Murphy, Metropolitan Bldg., Denver.
Place: Assembly Room of Metropolitan Bldg. Time: First Saturday of each month from October to May.

Connecticut State Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. J. J. Cohane, 59 College St., New Haven.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.

Eye, Ear, Nose and Throat Club of Georgia

President: Dr. Thomas H. Hall, Jr., 617 Mulberry St., Macon.
Secretary-Treasurer: Dr. J. A. Smith, 700 Spring St., Macon.

Indiana Academy of Ophthalmology and Oto-Laryngology

President: Dr. Robert J. Masters, 805 Hume-Mansur Bldg., Indianapolis.
Secretary: Dr. J. Kent Leasure, 611 Hume-Mansur Bldg., Indianapolis.
Place: Indianapolis. Time: Dec. 13, 1933.

Iowa Academy of Ophthalmology and Oto-Laryngology

President: Dr. W. W. Pearson, 410 Sixth Ave., Des Moines.
Secretary-Treasurer: Dr. W. F. Boiler, 105 East Iowa Ave., Iowa City.

Michigan State Medical Society, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Ray Connor, 28 W. Adams Ave., Detroit.
Secretary: Dr. Ralph B. Fast, 136 E. Michigan Ave., Kalamazoo.

Minnesota Academy of Ophthalmology and Oto-Laryngology

President: Dr. Harold J. Rothschild, 239 Lowry Bldg., St. Paul.
Secretary-Treasurer: Dr. W. E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month, October to May.

Montana Academy of Oto-Ophthalmology

President: Dr. Lawrence G. Dunlap, 101 Main St., Anaconda.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.
Place: Anaconda. Time: July 11, 1933.

New Jersey State Medical Society, Section on Ophthalmology, Otology and Rhinolaryngology

Chairman: Dr. Charles H. Schlichter, 556 N. Broad St., Elizabeth.
Secretary: Dr. B. E. Failing, 31 Lincoln Park, Newark.

New York State Medical Society, Eye, Ear, Nose and Throat Section

Chairman: Dr. D. F. Gillette, 109 S. Warren St., Syracuse.
Secretary: Dr. Frank M. Sulzman, 1831 Fifth Ave., Troy.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Axel Oftedal, 55½ Broadway, Fargo.
Secretary-Treasurer: Dr. F. L. Wicks, 516 Fourth St., Valley City.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. A. B. Dykman, Medical Dental Bldg., Portland.
Secretary: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Herman A. Winkler, 224 Thayer St., Providence.
Secretary: Dr. N. A. Bolotow, 108 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

SOUTH CAROLINA SOCIETY OF OTOLARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. Walter Bristow, Medical Arts Bldg., Columbia.
Secretary: Dr. J. W. Jervey, Jr., 101 Church St., Greenville.
Place: Columbia. Time: October, 1933.

TENNESSEE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. R. G. Reaves, 422 W. Cumberland Ave., Knoxville.
Secretary: Dr. Ralph O. Rychener, 1720 Exchange Bldg., Memphis.

TEXAS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. A. F. Clark, 388 Pearl St., Beaumont, Texas.
Secretary: Dr. A. F. Clark, 1034 Nix Bldg., San Antonio.
Place: Dallas. Time: Dec. 1-2, 1933.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. F. M. McHugh, 17 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. W. Leroy Smith, Erza Thompson Bldg., Salt Lake City.

VIRGINIA SOCIETY OF OTOLARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. Frank P. Smart, 142 W. York St., Norfolk.
Secretary-Treasurer: Dr. Henry Grant Preston, Professional Bldg., Harrisonburg.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. O. H. Bobbitt, Medical Arts Bldg., Charleston.
Secretary: Dr. Harry V. Thomas, 95 Fairmont Ave., Fairmont.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Elbert A. Curtis, 65 Central St., Newark.
Secretary: Dr. A. Russell Sherman, 671 Broad St., Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. G. E. Clay, 384 Peachtree St., N. E., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., 412 Medical Arts Bldg., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore City Medical Society, Section on Otology and Laryngology

President: Dr. James J. Chisolm, Medical Arts Bldg., Baltimore.
Secretary: Dr. Louis Diener, 2449 Eutaw Pl., Baltimore.
Place: 1211 Cathedral St. Time: 8:30 p. m., last Friday of each month.

Buffalo Oto-Laryngological Society

President: Dr. Charles B. Handel, 131 Linwood Ave., Buffalo.
Secretary-Treasurer: Dr. Carl G. Frost, 37 Allen St., Buffalo.
Place: Buffalo Club. Time: First Tuesday of each month from September to May, inclusive.

Chicago Laryngological and Otological Society

President: Dr. Charles Younger, 25 E. Washington St., Chicago.
Secretary-Treasurer: Dr. Austin A. Hayden, 25 E. Washington St., Chicago.
Place: Medical and Dental Arts Bldg., 185 N. Wabash Ave. Time: 6 p. m., first Monday of each month from October to May.

Cincinnati Oto-Laryngological Society

President: Dr. Henry M. Goodyear, The Doctors' Bldg., Cincinnati.
Secretary-Treasurer: Dr. Samuel Seltz, Provident Bank Bldg., Cincinnati.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Justin M. Waugh, Cleveland Clinic, Cleveland.
Secretary: Dr. James T. Collins, 1105 Medical Arts Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

College of Physicians of Philadelphia, Section on Otolaryngology

Chairman: Dr. Ralph Butler, 2007 Chestnut St., Philadelphia.
Clerk: Dr. Karl M. Houser, 1826 Pine St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., third Wednesday of each month from October to June.

Columbus Ophthalmological and Otolaryngological Society

Chairman: Dr. John B. Alcorn, 167 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. Edward W. Harris, 681 E. Broad St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Otolaryngology

President: Dr. O. M. Marchman, 1717 Pacific Ave., Dallas, Texas.
Recording Secretary: Dr. W. Mood Knowles, 1717 Pacific Ave., Dallas, Texas.
Corresponding Secretary: Dr. J. M. Potts, 1717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. C. F. Howland, 604 Locust St., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Ia.
Time: Third Monday of each month, September to May, inclusive.

Detroit Oto-Laryngological Society

President: Dr. R. Lee Laird, 513 David Whitney Bldg., Detroit.
Secretary-Treasurer: Dr. J. M. Sutherland, 8-257 General Motors Bldg., Detroit.
Place: Maccabees Bldg. Time: Third Wednesday evening of each month from October to May.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. R. H. Needham, 1304 Medical Arts Bldg., Fort Worth, Texas.
Secretary: Dr. Van D. Rathgeber, 1011 Medical Arts Bldg., Fort Worth, Texas.
Place: University Club. Time: 6.30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. Carl F. Snapp, Medical Arts Bldg., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Walter W. Oliver, 26 Sheldon Ave., Grand Rapids, Mich.
Place: Various local hospitals. Time: 6:30 p. m., third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. J. F. Gamble, 201 Main St., Houston, Tex.
Secretary: Dr. B. F. Payne, 1304 Walker Ave., Houston, Tex.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-Laryngological Society

President: Dr. John W. Carmack, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: Indianapolis Athletic Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Otolaryngology

President: Dr. Albert N. Lemoine, 906 Grand Ave., Kansas City, Mo.
Secretary: Dr. Harold B. Hedrick, 618 Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

President: Dr. Ferris L. Arnold, 923 Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. Clyde E. Harner, 314 Security Bldg., Long Beach, Calif.
Place: Professional Bldg. Time: Last Wednesday of each month from September to June.

Los Angeles Society of Ophthalmology and Otolaryngology

President: Dr. D. E. Godwin, 910 Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. F. H. Brandt, 1052 W. Sixth St., Los Angeles.
Place: Los Angeles County Medical Association, 1925 Wilshire Blvd. Time: 8 p. m., fourth Monday of each month, September to May, inclusive.

Louisville Eye, Ear, Nose and Throat Society

President: Dr. Karl N. Victor, Breslin Bldg., Louisville, Ky.
Secretary-Treasurer: Dr. J. S. Bumgardner, Heyburn Bldg., Louisville, Ky.
Place: French Village. Time: 6:30 p. m., second Thursday of each month, September through May.

Medical Society of the County of Kings, Section on Otolaryngology

Chairman: Dr. Charles R. Weeth, 37 Remsen St., Brooklyn.
Secretary-Treasurer: Dr. Oscar Rodin, 893 Eastern Parkway, Brooklyn.
Place: Library Bldg., County Society, 1313 Bedford St., Brooklyn.
Time: 9 p. m., second Wednesday of January, March, May and November.

Medical Society of the District of Columbia, Section on Ophthalmology and Oto-Laryngology

Chairman: Dr. Albert P. Tibbets, 1801 I St., Washington.
Secretary: Dr. G. Victor Simpson, 1710 Rhode Island Ave., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

President: Dr. Samuel G. Higgins, 324 E. Wisconsin Ave., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 324 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Eugene Orr, 706 Church St., Nashville.
Secretary-Treasurer: Dr. H. C. Smith, Medical Bldg., Nashville.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month, October to June.

New Orleans Ophthalmological and Otolaryngological Society

President: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Secretary-Treasurer: Dr. R. H. Fisher, Chess and Checkers Club, New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: January to June and October to January—third Thursday of each month.

New York Academy of Medicine, Section of Otolaryngology

Chairman: Dr. Charles Imperatori, 108 E. 38th St., New York.
Secretary: Dr. David H. Jones, 140 E. 54th St., New York.
Place: 103d St. and 5th Ave. Time: 8:30 p. m., third Wednesday of each month from October to May.

Omaha and Council Bluffs Ophthalmological and Otolaryngological Society

President: Dr. L. G. Howard, 532, 1st Ave., Council Bluffs, Iowa.
Secretary-Treasurer: Dr. W. A. Cassidy, 1620 Medical Arts Bldg., Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: Dinner, 6 p. m. Program, 7 p. m., third Wednesday of each month from October to May.

Philadelphia Laryngological Society

President: Dr. Louis H. Clerf, 128 S. Tenth St., Philadelphia.
Secretary: Dr. Herman B. Cohen, 1301 Spruce St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., first Tuesday of each month from October to June.

Pittsburgh Otological Society

Chairman: Dr. Roy C. Cooper, 510 S. Aiken Ave., Pittsburgh.
Secretary-Treasurer: Dr. Alexander R. Hampsey, 806 May Bldg., Pittsburgh.

Richmond Ophthalmological and Oto-laryngological Society

President: Dr. R. W. Vaughan, Medical Arts Bldg., Richmond, Va.
Secretary: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. E. S. Amsler, 53 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. E. W. O'Brien, 5 N. Goodman St., Rochester, N. Y.
Place: Rochester Medical Association, 13 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ear, Nose and Throat Club

Acting President: Senior member of the executive committee: Dr. William E. Sauer, 3720 Washington Blvd., St. Louis.
Secretary: Dr. B. J. McMahon, 813 Missouri Bldg., St. Louis.
Place: University Club Bldg. Time: Third Wednesday in February, April, October and December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Charles J. Boehs, 1126 Medical Arts Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. E. D. Dumas, 425 Medical Arts Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Robert Carson Martin, 384 Post St., San Francisco.
Secretary: Dr. George N. Hosford, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco. Time: Third Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. T. D. Boaz, Medical Arts Bldg., Shreveport, La.
Secretary-Treasurer: Dr. W. L. Atkins, 940 Margaret Pl., Shreveport, La.
Place: 1240 Texas Ave. Time: 7:30 p. m., first Monday of each month from October to June.

Spokane Academy of Ophthalmology and Otolaryngology

President: Dr. David Hartin, Old National Bank Bldg., Spokane, Wash.
Secretary: Dr. W. W. Henderson, Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. W. G. Dickinson, 109 S. Warren St., Syracuse, N. Y.
Secretary-Treasurer: Dr. Harold H. Joy, 109 S. Warren St., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Tulsa Academy of Ophthalmology and Otolaryngology

President: Dr. Roy W. Dunlap, 108 W. 6th St., Tulsa, Okla.
Secretary-Treasurer: Dr. Marvin D. Henley, 108 W. 6th St., Tulsa, Okla.
Place: Medical Arts Bldg. Time: Monthly.